

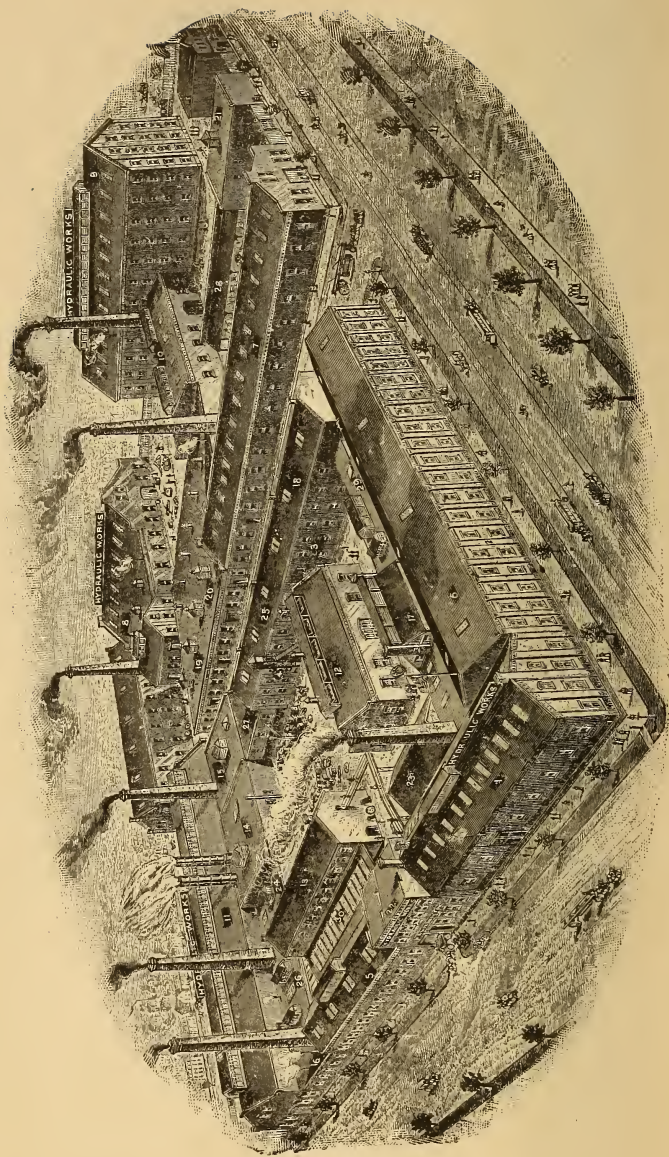


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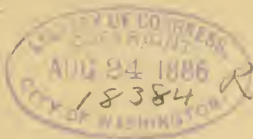


HENRY R. WORTHINGTON HYDRAULIC WORKS.

THE
CITY OF BOSTON;

Its Steam Interests and Leading
Engineers.

PRICE, \$2.50.



1886:

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BOSTON.

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PUBLISHER'S NOTE.

Of the aims of this work only a few words need be written. As a city of metropolitan influence and industrial and commercial importance, Boston stands today conspicuously prominent among the cities of the Union. Her interests in various directions have frequently and eloquently been extolled, her sons have carved for her a glorious name on the pyramid of time, her enterprising merchants have carried her prestige to Russia, India and China, and her name is continually before us as the champion of genius and the home of science ; but as yet we have seen nothing touching upon the subject of the following pages. The discovery of steam as a motive power has proved one of the most important of the age, and in all its greatness has perhaps conduced more to the commercial and industrial interests of the world in the last one hundred years than almost any other.

Its improvements have been many and great, and those who have devoted their lives to its service have given to us augmented systems, and have largely contributed to the advancement of science.

This work is designed simply as an outline history of the steam engine from its earliest conception to the present time, with a description of the steam plants of Boston as they are today, together with half-minute sketches of the

lives of its leading engineers, and a review of prominent manufacturers of appliances which go to make up a steam plant over which an engineer has charge.

While some of the better known names among the engineers are referred to at length, there are also those who although at present not occupying positions of such prominence, are each probably as important in their special sphere, and are therefore among the leading engineers of the city. In conclusion the publishers acknowledge the valuable aid rendered in the work of compilation by numerous gentlemen, and to Robert Scott Burns, author of "The Steam Engine," and hereby extend their most cordial thanks for the assistance thus rendered.

HISTORICAL PUBLISHING CO.

BOSTON, Aug. 1, 1886.

THE STEAM ENGINE.

THE ancients are known to have had an acquaintance with the utility of the power of steam and heated air, and had devised certain contrivances in which this power was developed. These contrivances were applied to no purpose of utility, but served as the means to excite the wonder of the populace, as the miraculous production of their priesthood, and as forming part of the mysteries of their worship. Thus, one of the contrivances of the well-known Hero of Alexandria—the first personage who figures in the stereotyped history of the steam-engine—who flourished 130 years before Christ, was for the purpose of causing wine to flow from the hands of images placed before the altar.

It is somewhat remarkable—as taking the era of the introduction of steam and heated air as a motive power much further back than is generally supposed—that Hero states that he made himself acquainted with the labors of his predecessors and contemporaries in connection with pneumatical contrivances, and that many of those which he describes in his *Spiritualia seu Pneumatica* were not of his own invention; thus inducing the belief that this power was known for ages previously, although its operation, doubtless, was only known to the priests, by whom it was applied chiefly, if not exclusively, for the purpose of exciting a belief in their worshippers of supernatural invention. What schoolboy has not read of the mysterious Memnon,

whose mystic utterance of sounds has even yet, in these utilitarian days, "a distinct and mysterious interest, for no myth of the most graceful mythology is so significant as its story." Yet the "seven mystic vowels, which are the very heart of mysteries to us," are said to have been produced by some of those pneumatic contrivances which Hero describes. "When the secrets of the waning faith," says an elegant writer, "were revealed by the votaries of a rival belief, the celestial harmony was then said to be produced by vapor, rising from water concealed in a cavity of the statue, being made to pass through a tube having a small orifice fashioned in a manner similar to that of an organ. As long as the fluid was heated by the rays of the sun, mysterious sounds were heard by the assembled worshippers, which died gradually away as the solar influence was withdrawn from the gigantic idol."

At this stage of our progress an inquiry will naturally arise—how is it, that with all the ingenuity of the ancients, so fertile and so suggestive a power should have been allowed to remain developed only in the devices of priestcraft, and not have been adapted to the purpose of a varied and general utility? The cause of this apparent neglect may be traced to the same sources which influenced the obscurity which has hid from later times the art of antiquity. For centuries no attention seems to have been paid to the development of the power of steam; nevertheless, there are sufficient indications of the fact that its power was not altogether unobserved by philosophers and men attached to science; many in their writings hinting at the power to be derived from "vapor," and alluding confidently as to the capability of huge "engines" being forced into motion by the power of this agent. About the year 1121, according to William of Malmesbury, "there were extant in a church

at Rheims, as proofs of the knowledge of Gerbert, a public professor in the schools, a clock constructed on mechanical principles, and a hydraulic organ in which the air, escaping in a wonderful manner by the force of heated water, fills the cavity of the instrument, and the brazen pipes emit modulated tones through multifarious apertures." On the revival of learning throughout Europe, the dissemination of the writings of the ancient philosophers doubtless attracted attention to many of these contrivances. There is some probability attached to the supposition that the invention of Blasco de Garay, a sea captain, introduced into notice in 1543, was founded upon or derived from one of these. This was designed for the propulsion of vessels, and appears to have been comparatively efficient. Unfortunately no record is known to exist from which a knowledge of its parts can be ascertained.

Solomon de Caus, in a work dated Heidelberg, in 1615, entitled *Raisons des Forces mouvantes avec diverses Machines tant utiles que plaisantes*, amongst a variety of insignificant and fanciful theories and descriptions, gives an arrangement by which water is raised above its level.

In 1629, in a work published by Giovance Branca, a description is given of a contrivance in which the force of steam was used as the actuating power. The water is heated in a vessel the upper part of which is fashioned like a head; from the lips of this a pipe or tube issues, which directs the steam against the vanes or boards of a wheel, made somewhat like an undershot wheel; this is made by the impinging of the steam on the floats or vanes, to rotate rapidly.

From the period now reached, up to the middle of the seventeenth century, history records no advance towards the improvement of the steam-engine. All the contrivances heretofore noticed seem to have been more the result of

closet study than every-day practice : more to be looked upon as the playthings of philosophers than the purposed inventions of the practical mechanic. To this, however, De Garay's steamboat propeller may perhaps be an exception ; nevertheless it can be classed only as an experiment, and the barren results of which, in all probability, arose from some inherent defect in its principle or construction. At all events, up to the interesting period we now approach, no useful application of steam to the practical purposes of every-day life had yet been successfully introduced.

In 1698 Savery obtained a patent from William the Third "for raising water, and occasioning motion to all sorts of mill work, by the impellant force of fire ;" and in 1699 he exhibited a model of his engine before the Royal Society, a description and illustration of which is given in their *Transactions*, vol. xxi. p. 228. In 1702 he published a work entitled *The Miner's Friend*, written in a lively and interesting style, and containing a full and circumstantial account of the arrangements and operation of the engine.

Toricelli, after the death of Galileo, discovered that the flowing of water (open to the atmosphere) into any vacuum space was owing to the pressure of the atmosphere, acting upon all bodies at the earth's surface with a definite pressure. In 1672 the celebrated Otto Guericke, in his *Experimenta Magdeburgica*, detailed an apparatus by which he could raise heavy weights.

In the spring of 1712 Newcomen succeeded in obtaining a contract for drawing water from a mine at Wolverhampton. The erection of this engine was the occasion of a quicker means of obtaining a vacuum being accidentally discovered.

In 1767 Smeaton was employed to construct an engine for the New River Company, and he availed himself of this opportunity to introduce several improvements.

The result of the experiments conducted with a trial engine Smeaton carefully tabulated, and took as a guide to regulate his future practice. The engines of a large class which he afterwards erected fully verified by their performance the correctness of his assumptions, and evinced the practical care with which he had, in this as in other matters, conducted his experiments. In 1772 he was employed to construct an engine at Long Benton Colliery, at Newcastle, and in this he introduced the several improvements suggested by his experiments, similar in construction to that introduced by Beighton: it was, however, "distinguished by juster proportions and greater nicity of detail than had yet been realized; and the innovations thus introduced were found to be highly beneficial in practice." The engine erected by Smeaton, and known as the "Chacewater Engine," was the most celebrated of his performances. Although there is nothing in connection with the improvement of the atmospheric engine which can be said to be the invention of Smeaton, still the higher praise is given to him of "giving the most perfect form and proportion to those materials supplied by his predecessors and contemporaries."

Such was the degree of perfection to which the steam-engine had arrived. The principles of its action apparently precluded the attainment of a higher degree of practical usefulness, and it remained for a brighter genius and a more original mind to thoroughly grapple with and to understand its defects, and, by opening up a new path of discovery, to place the steam-engine, as a social power of rare value, in the high position to which its wonder-working powers have fairly entitled it.

In the year 1736, at the little town of Greenock, on the banks of the Clyde, James Watt was born. Of a slender form, sickly appearance, retiring and bashful in his manners,

and bearing with him no evidence of an intellectual capacity superior to his fellows, this youth, unaided by family, wealth, or station, or even by the adventitious aids of an early liberal education, was destined, during a long and active life, to be the means of introducing a power which aided his country materially during a time of difficulty and danger, and to leave behind him a name world-wide in its reputation.

When about sixteen years of age, he became acquainted with an obscure mechanic in Glasgow, who, "by turns a cutler and whitesmith, a repairer of fiddles, and a tuner of 'spinnets,' was a useful man at almost everything," and in consequence of adding to this list of accomplishments "a knowledge of the construction of mathematical instruments and of 'spectacle-glasses,' he was dignified by the title of 'optician.'" To this individual Watt, in his sixteenth year, was apprenticed, chiefly, as is probable, from the fact that it offered an easy calling suitable for his delicate health, than from any inducement it held out as that by which he could afterwards make a fair livelihood. After a short apprenticeship of less than two years, James Watt removed to London, where he succeeded in obtaining employment under a regular mathematical-instrument maker. Here he obtained that knowledge of business habits and processes which had been withheld from him in his earlier engagement. His stay in London was very limited, and probably from a severe cold which he caught while following his avocations, and the effects of which he felt for many years afterwards, he returned to his native town after an absence of little more than a year. He next endeavored to raise a business of his own, and began to practice both in Greenock and Glasgow. In the latter place he met with an obstacle which threatened to put a sudden stop to his progress; this arose

from the fact that he was not a "freeman," or "burgess," of the town. One spot, however, existed, within the boundaries of which all such absurd laws and regulations were inoperative, this was the "College of Glasgow." By the kind offices of some of the dignitaries, Watt was appointed mathematical-instrument maker to the university, and a room was allotted him within its precincts, in which he could carry on his avocations without molestation. Thus was the apparently untoward circumstances amply compensated for. And it is by no means idle to conjecture what would have been the results on the future progress of the steam-engine had that absurd law not been in existence which drove Watt out of what might be looked upon as the open path of commerce, to take refuge in the place, of all others, the best fitted for, and offering the most eligible opportunities of carrying on the series of experiments which, by a fortuitous chain of circumstances, were shortly presented to his notice, and by the successful prosecution of which he was destined to make himself so famous.

In the year 1759, while in this situation, Watt had his attention directed to the subject of the steam-engine by Mr. Robinson, afterwards Professor of Natural Philosophy in the University of Edinburgh, and author of the well-known work entitled *Elements of Mechanical Philosophy*. The scheme proposed had reference to the moving of wheel-carriages by the aid of steam; but in consequence of Mr. Robinson leaving college, it was abandoned. Two years afterwards, however, Watt again returned to the subject, and instituted some experiments with a Papin's digester; and formed a sort of steam-engine "by fixing upon it a syringe one-third of an inch in diameter, and furnished," says Mr. Watt, whose own account we now quote, "also with a cock to admit the steam from the

digester or shut it off, at pleasure, as well as to open a communication from the inside of the syringe to the open air, by which the steam contained in the syringe might escape. When the communication between the cylinder and digester was opened, the steam entered the syringe; and by its action upon the piston, raised a considerable weight (15 lbs.), with which it was loaded. When this was raised as high as was thought proper, the communication with the digester was shut off, and that with the atmosphere opened; the steam then made its escape, and the weight descended. The operations were repeated; and though in this experiment the cock was turned by hand, it was easy to see how it could be done by the machine itself, and make it work with perfect regularity. But I soon relinquished the idea of constructing an engine upon this principle, from being sensible it would be liable to some of the objections against Savery's engine, namely, from the danger of bursting the boiler, and the difficulty of making the joints tight; and also that a great part of the power of the steam would be lost, because no vacuum was formed to assist the descent of the piston."

Two years after relinquishing his experiment, as above stated, his attention was again directed to the subject, by a model of a steam-engine on Newcomen's plan, belonging to the Natural Philosophy class, which was placed in his hands to be repaired (1763-4). At first directing his attention to the dry matter-of-fact details of the task intrusted to him, his active mind at length received a new impulse from the result of one or two trials of the engine, and he directed the full energy of his intellect to master the principle of the machine, and to ascertain the cause of its defects as a prime-mover. In conducting the experiments, two things attracted his attention; the first was the great loss of steam from the

condensation caused by the cold surface of the cylinder ; secondly, the great quantity of heat contained in a small quantity of water when converted into steam. If a quantity of water is heated in a close boiler some degrees above the boiling-point, and the steam suffered to escape suddenly, the temperature of the boiling-water remaining in the boiler will be reduced to the ordinary boiling-point. The steam, however, which escapes, although carrying off all the excesses of heat, would, if condensed, form but a small quantity of water. The saving of this heat was therefore a matter of the highest importance. The loss of steam occasioned by the alternate heating and cooling of the cylinder was sufficient to fill the cylinder three or four times, and to work the engine. "By means of a glass tube inserted into the spout of a tea-kettle, he allowed the steam to flow into a glass of cold water until it was boiling hot. The water was then found to have gained nearly a sixth part by the steam which had been condensed to heat it, and he drew the conclusion that a measure of water converted into steam can raise about six measures of water to its own heat, or eighteen hundred measures of steam can heat six measures of water." "Hence he saw that six times the difference of temperature, or fully one hundred degrees of heat, had been employed in giving elasticity to steam, and which must all be subtracted before a complete vacuum could be obtained under the piston of a steam-engine." "Being struck," says Mr. Watt, "with this remarkable fact, and not understanding the reason of it, I mentioned it to my friend Dr. Black, who then explained to me his doctrine of latent heat, which he had taught some time before this period (summer of 1764) ; but having been occupied with the pursuits of business, if I had heard of it I had not attended to it, when I thus stumbled upon one of the material facts by which that beautiful

theory is supported." In making his experiments, Watt found that the boiler of the model, although of size sufficient according to the standard then in use, did not supply steam fast enough for the wants of the engine, which had a cylinder two inches diameter and six inches stroke. A large quantity of injection-water was also required to effect a very imperfect vacuum. These defects he attributed to the fact that a small cylinder consumed a greater quantity of steam than a larger one, in consequence of the condensation caused by the increased surface in proportion to its capacity. This defect he sought to remedy by substituting a cylinder made of materials which would conduct heat more slowly than brass, of which the model cylinder was made. For this purpose he constructed one of wood soaked in linseed-oil, and baked dry. This, however, was a failure for in addition to its want of durability, an essential feature in practice, it was found to condense the steam as much as before. The principal loss sustained was evidently, therefore, by the alternate heating and cooling of the cylinder; and the conviction was forced upon him that the grand secret lay in being able to effect the condensation of the steam without cooling the cylinder. To the attainment of this, Watt directed his whole energies, and in the year 1765 the felicitous idea struck him, "that if a communication were opened between a cylinder containing steam, and another vessel were exhausted of air and other fluids, the steam, as an expansible fluid, would immediately rush into the empty vessel, and continue to do so until it had established an equilibrium; and if that vessel were kept very cool by an injection or otherwise, more steam would continue to enter until the whole was condensed." This brilliant idea was soon put to the test of experiment and found correct; and thus was solved the great problem which had

for so many years perplexed and baffled his predecessors. It is said that as soon as this happy thought had been realized, all the train of details necessary to carry it into efficient practice followed in rapid succession ; and that not for a moment had he any hesitation in conceiving the rapid and immediate perfecting of the whole machine. In carrying out the idea into practice, the first difficulty that presented itself to the mind of Watt was, doubtless, a means of relieving the condenser from the accumulated water which would result from the successive condensations effected in it. This might, of course, have been drawn away by the simple force of gravity, by using a pipe thirty feet long, as in Newcomen's engine. This plan, however, could not be effectual for removing the uncondensed steam, or the air that might find its way into the condenser. Some other plan was therefore desiderated. Watt proposed and adopted a pump which would draw off the contents of the condenser, this pump to be worked by the engine itself. This constituted another step towards the perfecting of the mechanism : others rapidly followed. The next improvement was surrounding the cylinder with a casing, by which the heat would be retained. This of itself, however, would not effect the desired end ; he therefore, to prevent the action of the cold atmosphere on the upper surface of the piston, and on the interior surface of the cylinder, which would necessarily be exposed on its descent, closed the top of the cylinder with a close-fitting cover, in the centre of which the piston-rod worked through an aperture rendered tight by what is termed a "stuffing-box." The necessity of adopting the next expedient suggested to him was thus made obvious ; and in place of the power of the atmosphere he employed the "*elasticity of the steam from the boiler to impel the piston down the cylinder.*" By this arrange-

ment the method previously adopted to keep the piston tight, by water on its upper surface, was done away with : and instead, Watt adopted a hemp-packed piston lubricated with tallow. Thus, by successive improvements, the atmospheric engine was changed into a "steam-engine."

Before describing the improvements introduced by Watt, we propose to trace further the points connected with their history. Although the claim of Watt to the originality of the idea of separate condensation is now generally, if not universally, acknowledged, still it is but right to notice that of another party to this high honor. A claim is put forward by Mr. Hornblower, a rival and contemporary of Watt, in Gregory's *Mechanics* (vol. ii. first edition, p. 362).

Having satisfied himself as to the correctness of his principle, Watt proceeded to test it still further by the aid of a model on a large scale. The cylinder of this model was nine inches diameter, and the piston-rod was attached to a balanced beam. An accident, however, occurred, which, along with his want of means, as well as of time to prosecute his experiments, brought his labors to a close. Having taken up the practice of a land-surveyor and engineer, and his time being pretty fully occupied, the invention lay dormant on his hands for three or four years. His silence on the matter doubtless proceeded from a variety of causes, the principal of which was, likely, the fact that as a fair trial could only be given to his engine on a large scale, the risk of bringing it out would be too great, the apparatus required being exceedingly costly. From Watt's practice as an engineer, he became acquainted, however, with the celebrated Mr. Roebuck, an enterprising English gentleman resident in Scotland. An able practical chemist, he had succeeded in discovering a method of

making sulphuric acid at a comparatively low cost ; and being possessed of business habits and qualities of the first order, he succeeded in establishing at Prestonpans, near Edinburgh, a manufactory, in which the process was carried out on a large scale. The profits accruing from this establishment were such that he gave up the practice of his profession, and confined his attention to carrying out commercial projects on a large scale. He founded the celebrated iron-works at Carron, which, as a project, were highly successful. Urged by his success in this undertaking, he leased the estate of Kinneil, a few miles from Carron, and which contained extensive beds of coal. While carrying on his operations there with the same energy which characterized his other proceedings, he became acquainted with Watt, who, no doubt, struck by his ability and business habits, looked upon him as one in every respect calculated to aid the undertaking of bringing the steam-engine into practice, and accordingly confided to him the secret of his discovery. Dr. Roebuck consented to bear the expense of conducting trials on a large scale ; and Watt forthwith proceeded to construct a large engine under his inspection. For a period of eight months, alterations and improvements succeeded each other, until at last the engine was brought to a state of comparative perfection — so far, at least, as could be attained, from the imperfect style of workmanship then available. The engine was tried at a coal-mine on Dr. Roebuck's estate ; and such was the satisfactory nature of its operations, both as regarded the great saving of fuel and the water used for condensation, that Dr. Roebuck was satisfied as to its powers and capabilities, and closed with Watt, supplying the necessary funds to take out a patent, and to establish a manufactory for the production of the engines ; the terms of partnership being, that the money for the

above purposes was to be found by Roebuck, he obtaining two-thirds of the profits. On these terms Watt proceeded with his patent, which was taken out in 1769, after which he proceeded to perfect the details of his engine. From the bad workmanship which he had to contend with, his difficulties were of a serious kind ; that which harrassed him most being the difficulty of keeping the piston tight without incurring a heavy loss by friction. But another obstacle was about to be thrown in the path of progress, and which at one time bade fair to utterly ruin Watt's prospects of receiving a pecuniary reward for his great labors ; this was the bankruptcy of Dr. Roebuck. The coal-fields of Kinneil, instead of throwing a golden shower of profits into his lap, were the means of bringing him to ruin. But this apparently untoward circumstance was the means of ultimately placing Watt in the eminent position which he afterwards occupied ; so true, as we often find it, is the saying, that "man's extremity is God's opportunity."

The party with whom Roebuck negotiated for a transfer of his rights in the patent of Watt, was the celebrated Matthew Bolton, of Soho, near Birmingham ; a man whose name will always be handed down to posterity in conjunction with his more celebrated compeer. The transfer was effected, and partnership formed between Bolton and Watt. In character the very opposite in many respects of Watt, Bolton was possessed of rare business talents, an extensive acquaintance with business forms, and having that indomitable spirit of "perseverance which insures success" in an eminent degree ; these, united with a degree of courage in prosecuting his engagements in the face of difficulties, rendered him a fitting coadjutor for the retiring and unambitious Watt.

At the period of the transfer of Roebuck's rights in the patent to Bolton, Watt was engaged in the north of Scotland. Shortly after the death of his wife happening, he was induced to accept of the invitation of his partner, and to take up his abode at Soho.

Watt was now in a position to prosecute his labors with vigor, and surrounded by those mechanical appliances, without which the attainment of perfection in the working details was hopeless. An engine was accordingly erected ; and many Cornish adventurers, on invitation, greatly interested in the success of the engine, examined its operation. In their report they gave a favorable opinion as to the saving of fuel effected by it. Some years of the term for which the patent was valid had, however, expired ; and fearful that its whole period would pass over before pecuniary results accrued, so as to afford a profit, or to reimburse the large expenses which had been gone to in perfecting the engine, Watt, at the suggestion of Bolton and his other friends, applied to parliament for an extension of his patent. This, after some opposition, was granted for the term of twenty-five years, dating from the time of the grant, namely, 1775. This extension was no doubt deserved, no less a sum than £50,000 having been expended in the manufacture of the engines by the firm before any return was realized. Having thus secured for a lengthened period the profits which might accrue from the sale of the engines, Watt was now in a position to introduce his machine with every advantage to the public. In this he was materially assisted by the admirable commercial arrangements of Bolton, who, after the grant of extension, became a partner with Watt in the manufacture of the machines ; thus sharing the profits on his head, as well as those derived from a monopoly of the principle. " Had

Watt," says Playfair, "searched all Europe, he could not have found another man so calculated to introduce the invention to the public in a manner worthy of its importance."

The most public and open inspection of the engines at work was invited, and every means taken to afford just opportunities of ascertaining their value. A congress of mechanics and scientific men was convened at Soho, and an elaborate series of trials made and comparisons instituted between its working capabilities and one on the principles of Newcomen of the best construction, in order to show the superior working capabilities of the new engine; these were manifest to all. But still further to place the merits of the machine on a basis which would satisfy all as to the character of its claims, the patentees issued the following:

"All that we ask from those who choose to have our engines, is *the value of one-third part* of the coals which are *saved* by using our improved machines, instead of the old. With our engine, it will not, in fact, cost you but a trifle more than half the money you now pay to do the same work, even with one-third part included; besides an immense saving of room, water, and expense of repairs. The machine itself which we supply is rated at that price which would be charged by any *neutral manufacturer* of a similar article. And to save all misunderstanding, to engines of certain sizes certain prices are affixed." To aid in the introduction of the new machines, Bolton and Watt took old atmospheric engines off the hands of those who wished to lay down the improved form, and this frequently at a rate above their value.

Again, in estimating the power of their engines, or calculating the work which each could perform, Bolton and Watt, instead of placing the estimate of a horse's work at

a low figure, and thus in the same proportion increasing the power of their engine, they actually increased the power of a horse's work to one-third. Smeaton had valued the work done by a strong horse as equal to lifting a weight of 22,000 pounds one foot high in a minute; Bolton and Watt estimated it at 33,000. But more than this, they stated engines were "calculated so that they will raise 44,000 pounds one foot high with a bushel of coals; and when we say our engines have the force of five, ten, or more horses, we mean and guarantee that they will lift 44,000 pounds for each horse power." On these terms, an engine which, according to Smeaton's estimate, was equal to twenty horses, was, according to Bolton and Watt, only equal to ten; thus giving the purchasers of the new engine an advantage of 100 per cent. in value for no increase of cost.

Thus placed before the public on terms so highly liberal, the invention made rapid progress in public favor: and some idea of the profits accruing may be derived from the fact, that at Chacewater mine, Cornwall, the saving of fuel effected was equal to \$30,000 annually; \$10,000 of revenue from this one source being drawn by the firm.

The manufacture of the engines increased with such rapidity, that the original establishment at Soho was found too limited in its dimensions for the great quantity of work now found to flow into the factory. Another was therefore constructed in the neighborhood, in which the operations could be carried on with that degree of concentration so essential to the turning out of work rapidly and efficiently.

We now come to notice an important improvement in the working of steam-engines, which the fertile genius of Watt added to the list of his brilliant inventions: this was working the steam expansively. The patent for the expansive steam-engine was taken out in 1782, but the attention of

Watt had been directed to the principle many years before ; in 1769 he wrote to Dr. Small, as to a "method of still doubling the effect of steam, and that tolerably easy." Many matters, however, diverted his attention from this important point ; and it was not until the above date that he took steps to introduce an engine in which the principle was carried out. To understand its *rationale* is so important to the student of the steam-engine, that we propose to enter into its consideration at some length.

Where steam is admitted to press on the top of a cylinder during the whole of its descent, the piston will move downwards with an accelerating velocity, which, if not checked, will materially damage the mechanism. An able authority supposes that the value of the expansive principle was made known through the result of some trials made to moderate the velocity of the piston, and lessen the shock as the piston reached the bottom of the cylinder. In Newcomen's engine he supposes this to have been effected by shutting the injection-cock earlier ; and in Watt's condensing engine, by shutting "the steam-valve at such a period of the stroke as would prevent the catch-pins from striking." To shut the steam-communication from the boiler, at a certain part of the stroke of the piston, to allow the steam to expand as the piston descends, constitutes the principle of "working expansively." By the action of the well-known law of pneumatics the pressure of the steam on the piston decreases as the space increases into which the steam has liberty to expand itself ; thus if the steam is cut off at one-fourth of its stroke, the pressure will, at the end of the stroke, exert only a force of one-fourth of its original pressure. By thus decreasing the power, a simple method of equalizing the tendency to an accelerated motion was attainable. In addition, however, to this advantage, a still

greater one resulted from the adoption of the principle, in the economization of steam, and the consequent saving of fuel. If steam of the temperature of 212 degrees "flows into a cylinder six feet long, until the piston has moved eighteen inches downwards, when this quantity has expanded into double its former volume, and in doing so has pressed the piston to the middle of the cylinder, it will exert a pressure of not more than 7 pounds on each square-inch area of the piston. When the piston has been depressed another eighteen inches, the vapor will have expanded into three times its original bulk, and will then urge the piston downwards with a force of not more than $4\frac{1}{2}$ pounds on each square inch; and when it has reached the bottom of the cylinder, and expanded into four times its original bulk, it will not exert a greater energy than about $3\frac{3}{8}$ pounds on each square inch. If now we calculate the varying power of the steam from the commencement to the termination of its stroke, beginning with a force of 14 pounds, and ending with $3\frac{3}{8}$ pounds, it will have exerted an average pressure of nearly $8\frac{1}{2}$ pounds on each square inch of the piston. But if the vapor had been permitted to flow freely into the cylinder as fast as the piston descended, it would have pressed it with a force of 14 pounds during the entire stroke of the piston. We thus see that one foot and a half of steam, acting expansively, has pressed $8\frac{1}{4}$ pounds through six feet; while six feet of steam, operating with its energy uniform and unimpaired, has only carried 14 pounds through six feet; thus showing that more than one-half of the whole steam has been saved by making it act expansively.

"Although the saving of steam is very considerable by making it work expansively, the power of the engine is reduced; thus, where the steam is cut off at one-fourth of the stroke, while the efficacy of the steam is increased four

times — that is, one-fourth the quantity of steam will complete the stroke,— the power is diminished nearly one-half. In engines worked expansively, therefore, the size of cylinder must be increased in proportion to the extent to which the expansive principle is carried. But although the engine is made larger to do the same quantity of work, this will be done with a less consumption of fuel ; this is obvious from the consideration, that at whatever point the steam is cut off, so much steam is saved ; and that the steam, although it exerts a gradually decreasing force on the piston, still exerts a power of some extent, which power, whatever may be its amount, is gained without any expenditure of steam. To carry out the system of expansive working most conveniently, it is best to use steam of a pressure considerably higher than that of the atmosphere : unless this pressure is considerable, expansion cannot be carried out to any great extent with advantage ; for if steam of a low pressure were used, the ultimate tension would be reduced to a point so nearly approaching that of the vapor in the condenser, that the difference would not suffice to overcome the friction of the piston, and a loss of power would be occasioned by carrying expansion to such an extent. It is clear that in the case of engines which carry expansion very far, a very perfect vacuum in the condenser is more important than it is in other cases.” The advantage of applying steam expansively will be seen by an inspection of the following table : if the steam is cut off at one-half of its stroke, the performance of the engine will be multiplied 1·7 times ; at

$\frac{1}{3}$	.	.	.	2·1	$\frac{1}{6}$	.	.	.	2·8
$\frac{1}{4}$	.	.	.	2·4	$\frac{1}{7}$	.	.	.	3·0
$\frac{1}{5}$	.	.	.	2·6	$\frac{1}{8}$	.	.	.	3·2

Watt effected the steam at any desired point by merely altering the position of the tappets or projecting pins in the

plug-frame, by which the valves were actuated upon at the proper time. As the motion of the piston was necessarily variable when the expansion principle was adopted, Watt contrived several ingenious mechanical combinations, by which the effect of the engine on the work it had to perform was uniform : he, however, did not apply these to any great extent, as he employed steam a little greater in pressure than that of the atmosphere, cutting off only at one-third or one-fourth, according as circumstances dictated.

The reader desirous of becoming acquainted with these further evidences of Watt's inventive talent, will find several plans figured, by which this uniformity was obtained, in Stuart's *Descriptive and Historical Anecdotes of Steam-Engines*. We proceed to the consideration of more interesting and important matters in connection with the inventions of Watt.

Under the new arrangements it was a matter of importance to ascertain the state of the vacuum in the condenser and cylinder ; for on the perfection of this obviously depended the efficiency of the engine. In order to ascertain this, Watt applied a mercurial barometer, connected with the inside of the pipe leading to the condenser : and another barometer was placed in connection with the boiler. The rise and fall of the mercury in the barometor attached to the condenser indicated the degree of exhaustion which had been made in it ; and by the same operation in the barometer attached to the boiler, he had a measure of the pressure of steam acting in the piston : from the data thus obtained, he was able to calculate with considerable precision the amount of power given out by the engine.

The zero point of the scale is so adjusted, that the pointer will point to it when the cylinder is filled with air ; and the pressure on both sides of the piston of the indicator

is equal. On a vacuum being made in the steam-cylinder, the piston of the indicator is forced downwards; and the spring being thus put in a state of tension, the pointer will indicate the different points in the scale, corresponding to the degree of vacuum in the cylinder. When the cylinder becomes filled with steam, the piston of the indicator rises, and it falls again on the vacuum being made. Thus the power of the engine at any period of its stroke is faithfully transferred to the piston of the indicator, and by this means the power of the engine is estimated.

At the present time the principle of this engine is still the same; the modifications in the details, arising from greater perfection in workmanship, although tending to give an appearance of greater elegance to its form, have not been extended to its principle of action. To such a high state of perfection did Watt bring it, that an eminent authority states that a pumping-engine "made after Watt's primitive type, would, with an equally effectual boiler, and an equal means of clothing and expansion, do about the same amount of duty as the best of the modern construction.

The single-acting engine although admirably adapted for the purposes for which it was introduced, namely, withdrawing water from coal and other mines, was obviously unfitted for extension to other purposes in which a continuous rotatory motion was desired. By a slight modification of the valves of his engine, Watt was enabled to overcome the difficulty; and in the "double-acting engine," for which we are indebted to his genius, the piston is both raised and depressed by the action of the steam, a vacuum being alternately made above and below the piston. In 1781 he took out a patent for this modification, but his attention had been drawn to it many years before; in fact, while prosecuting his petition for a prolongation of his original

patent in 1774, he had exhibited a drawing of the plan to the House of Commons. In this drawing he explained how, after the piston had been pressed by the steam to the bottom of the cylinder, by shutting off the connection between the upper part and the boiler, and opening a communication between it and the under side of the cylinder, the steam by this means could be made to *raise* as well as *depress* the piston into a vacuous space, *which might be made above and below it alternately*. For the introduction of this form of engine, by which the dead weight of the counterpoise was got rid of, the efficacy of the engine as a general motive power vastly increased, and the range of its powers so much extended, we are probably indebted to the rivalry which existed between the firm of Bolton & Watt and other engine-makers, and to the machinations which many of them condescended to employ for the purpose of obtaining a share of the public patronage. Holding such an extensive monopoly, a monopoly not only of legal power, but also, it may be said, of mechanical genius, and of a vast experience such as no others could lay claim to, it need not be wondered at that the firm encountered a vast amount of obloquy and reproach from various interested sources, and that angry feelings and bitter animosity on the part of their rival brethren in the trade existed to a large extent.

In the application of the steam-engine to the production of a *continuous* motion, the first step to be taken was to change the reciprocating motion of the piston-rod into a continuous rotatory one. If the reader will turn to pp 47-49 *Mechanics and Mechanism*, he will there find a description of a method to effect this purpose by means of what is called a "crank." Although the works of philosophy and mechanics published at periods long anterior

to the time of Watt and his contemporaries contained illustrations of this contrivance, and although, moreover, evidence of its use could be seen in almost every street in the knife-grinder's wheel (see p. 48, fig. 72, *Mechanics and Mechanism*), or in many houses in the country in the "housewife's spinning-wheel," the animated rivalry which existed between several mechanics who claimed the honor of its discovery, as an important appliance of the steam-engine, is very remarkable ; the great importance which was thus attached to its exclusive possession may be viewed, therefore, "as one of the many curious illustrations afforded, in the progress of this machine, of the great value of even an apparently trifling improvement."

In the year 1779 a Matthew Wasbrough, of Bristol, patented a contrivance by which the balanced beam of the atmospheric engine could produce a rotatory motion ; and a Mr. John Pickard took out a patent in 1780 for producing rotatory motion, by substituting the crank.

From Mr. Watt's own statement there appears every reason to conclude, that the idea of using the crank had been borrowed from his factory at Soho. But to avoid litigation he took out, in 1781, a patent for another method, namely the "sun-and-planet wheels."

The mechanism of the "sun-and-planet" wheels above alluded to, for the purpose of obtaining continuous rotatory motion from the reciprocating movements of the piston-rod, the reader will find explained in pp. 70-77, fig. 142, *Mechanics and Mechanism*.

The method employed in the single-acting engine for connecting the piston-rod with the end of the working beam was obviously (see p. 84, fig. 164, *Mechanics and Mechanism*) incapable of being applied to the double-acting engine ; where the piston was *pushed* up by the pres-

sure of the steam, not *pulled* up by the counterpoise, as in the single-acting engine.

This contrivance was found possessed of many disadvantages on being carried into practice, especially in large engines, not the least of which was the great noise and jar occasioned by the teeth of the rack and segment engaging as the direction of motion of the piston-rod was changed. Some more elegant contrivance was therefore desiderated, and Watt's genius and mechanical ability no more failed him here than at other and as trying times ; and the result of his cogitations was the production of that most beautiful and philosophical mechanism known as the "parallel motion." The principle of this contrivance the reader will find in p. 84, fig. 165, *Mechanics and Mechanism* ; and an exemplification of its arrangement as carried out in practice in the diagram fig. 63, p. 44 of the same work.

In order to render the double-acting engine as perfect in its arrangements as possible, and independent of the attention of careless workmen, Watt introduced a method by which the engine itself regulated its own motion. This he effected by adopting what is now known as the "governor," a description of which will be found in pp. 87-89, *Mechanics and Mechanism*, also illustrations showing its application to the opening and closing of the valve by which the steam is admitted to the engine. In the single-acting engines the throttle-valve was opened and shut by hand, a sufficient uniformity of motion being thus obtained.

The "governor" was not the sole invention of Watt ; in the application of it, however, to the steam-engine, it received the impress of his mechanical genius, and was, as it left his hands, in elegance and justness of proportion, and in original adaptation to his peculiar purposes, a very different affair than when used for regulating the sluice of

water-mills, for which purpose, under the name of "lift-tenter," it was largely used. It is right, however, to state that, according to Stuart, a Mr. Clarke of Manchester, suggested the adaptation of the "lift-tenter" to the regulation of the motion of the steam engine.

We have next to notice the arrangements which Watt introduced for the purpose of making the boiler supply its own wants; thus adding to the means by which the steam-engine, in almost every respect, was made "automatic."

Previous to Watt's improved arrangements, the boilers of steam-engines were generally rude and clumsy affairs, ill adapted to raise steam either quickly or economically. This was owing, no doubt, partly to the low state of the mechanical arts, which precluded any attempt at nice adjustment of parts; and partly to no one studying the subject in all its bearings, in order to arrive at a knowledge of the just proportions necessary to attain the greatest amount of steam at the least expenditure of fuel. The shape, too, was chiefly dependent on caprice or preconceived notions, being confined principally to globular and hemispherical forms, with flat or concave bottoms. The waste of fuel from these boilers at length attracted the attention of practical men, with a view to remedy their defects. Boilers of an oblong form were therefore introduced, and the best of this kind, known as the "wagon" from its shape, owed its introduction to Watt.

And first, as to the important point of supply of water. A vertical pipe was connected with the boiler, and reached to within a few inches of the bottom. This pipe varied in height, according to the pressure of the steam employed in the boiler, allowing some 34 inches for each pound of pressure above that of the atmosphere. The top of this pipe was terminated by a small cistern, supplied with

hot water from the hot-water cistern ; this cistern was furnished with a valve, opening upwards ; the spindle was connected by the lever ; this lever vibrated on the centre attached to the side of the cistern ; one end of this lever was weighted with a counterpoise, and the other had a rod attached to it, which descended into the interior of the boiler, passing through a stuffing-box, and having, at its lower end, a stone float. The action of this apparatus was as follows :—

On the water getting too low the float sank, pulling with it the end of the lever, raising the counterpoise weight and the valve ; this allowed the water to descend the pipe to the boiler. As the level of the water rose, the float also rose, and actuating the lever, the valve was let into its seat, thus stopping the flow of water through the pipe. The safety-valve, instead of being open as in the old engines, was confined in a box, through the cover of which the spindle of the valve worked in the stuffing-box, and the steam which escaped was led by a pipe to the chimney-flue. Another safety-valve was also attached to it, and was termed “the internal safety-valve :” its office was to admit air to the interior of the boiler, when, by any means, a vacuum was formed in it by the condensation of the steam ; to effect this, the valve opened inwards. The gauge-cocks were used to ascertain the state of the water in the boiler. When one was opened, water was forced through it alone, steam through the other ; when this happened, the proportion of water in the boiler was accurately adjusted ; if, on the other hand, steam rushed through that cock which should have emitted water, the water was deficient, and *vice versa*. Access was had to the interior of the boiler, for the purpose of cleaning it out, etc., through the “man-hole door :” this was covered by a plate, and properly

secured. The steam for the engine was conveyed by the pipe.

We have now brought the history of the steam-engine up to the period when Watt ceased making his improvements on it. Such were the perfection of his contrivances and the nicety of his details, that he left little to be done towards its improvement by other hands.

We now hasten to conclude our notice of Watt. After the expiration of the period which parliament had granted him to monopolize the profits of the steam-engine, Watt retired from the firm, and leaving the management of the business to his son and the son of Bolton, retired from "that establishment which his genius had matured, and to which it had given a celebrity as wide as the boundaries of civilization, to the enjoyment of the fortune which he had accumulated from the meritorious and well-directed exertion of a life distinguished for its activity and usefulness. The patent expired in 1800; and in the house which he occupied while at Soho, he resided till his death, which event occurred on the 23rd of August, 1819. He had suffered some inconvenience through the summer, but was not seriously indisposed till within a few weeks of his death. He then became perfectly aware of the event which was approaching; and, with his usual tranquility and benevolence of nature, seemed only anxious to point out to the friends around him the many sources of consolation which were afforded by the circumstances under which it was about to take place. He expressed his sincere gratitude to Providence for the length of days with which he had been blessed, and his exemption from most of the infirmities of age: as well as for the calm and cheerful evening of life that he had been permitted to enjoy, after the honorable labors of the day had been concluded. And thus, full of years and honor, in all calmness

and tranquillity, he yielded up his soul without a pang or a struggle, and passed from the bosom of his family to that of his God."

In 1804 Arthur Woolfe, of Cambourne, in Cornwall, obtained a patent for an improved steam-engine, in which advantage was taken of the expansive properties of steam. He employed steam of considerable pressure to work the piston of a small cylinder; and on its escaping from this, it was applied to the piston of a cylinder much larger in size, and which communicated with a condenser. The properties of steam on which this engine was founded, and the truth of which Woolfe thought he had established, were as follows:—

Previous to his experiments being instituted, a fact had been asserted relative to the expansive property of steam, that with the expansive force of four pounds to the inch, steam was capable of expanding into a space four times its volume, and yet be equal thereafter to the pressure of the atmosphere. His experiments led him to infer, that steam of five pounds to the inch would expand into five times its volume; and that steam of 6, 10, 20 lbs. to the inch, would expand into 6, 10, 20 times its bulk, and still have a pressure equal to the atmosphere, without any additional supply of heat. On this supposed discovery of the expansive property of steam, he proportioned his cylinders: if he adopted steam of six pounds to the inch, his large cylinder was six times the volume of the small one. Experience, however, soon showed the fallacy of this opinion; indeed, Woolfe himself was the first to become aware of it, and in his after-practice he adopted different proportions. The principle, however, of his engine is still in vogue with many of our engineers of high standing, and is being carried out in numerous instances, and with great success; it being

beyond a doubt, that, by judicious arrangements, it is calculated to become an economical method of working.

We have now to notice the principle of "*the high-pressure steam-engine*," and a few historical points connected with it. The distinction between "low-pressure or condensing" engines, and "high-pressure or non-condensing" engines, is simple enough, and easily remembered. In the former, the steam, after it works the engine, is passed into the condenser, and a vacuum is formed on one side of the piston, it is then sucked down as it were, and by this means a considerable degree of power is obtained: in the latter, the steam, after working the piston, is passed at once to the atmosphere. An eminent authority thus distinguishes between the two, and draws a comparison between them: "All locomotive engines are of the high-pressure variety; and generally all engines are made on the high-pressure plan where the carriage of condensing water would be inconvenient, as the first cost of the machine becomes a point of more importance than an increased consumption of fuel. High-pressure engines are, *cæteris paribus*, necessarily more expensive in fuel than low-pressure engines, as they occasion the loss of the power derivable from a vacuum; and as the quantity of heat in the same *weight* of steam is nearly the same at all pressures, there is no counteracting source of economy to compensate for this deduction. The use of high-pressure engines in circumstances in which the low-pressure engine is applicable, is not to be commended; and the high-pressure engine is rarely employed for other purposes than locomotion on railways, except in the case of very small engines required for some temporary or trivial purposes. . . . Where high-pressure steam is employed, it is expedient to make the pressure considerable, as the deduction to be made for the pressure

of the atmosphere is less in proportion with a high than with a moderate pressure. Some locomotive engines are worked as high as 90 lbs. to the square inch." Notwithstanding the objections urged against the use of high-pressure engines, they are used in great numbers, and for an almost infinite variety of purposes in connection with our arts and manufactories. Although with steam of high pressure considerable danger exists in the liability to explosion of the boilers, still, from the general simplicity of detail, and the consequent cheapness in construction, and their extreme portability, we need not wonder at their extended use.

The merit of the introduction of the first high-pressure steam-engine belongs to Leupold, a native of Plunitz, near Zwickau. He described it in his celebrated work entitled *Theatrum Machinarum Hydraulicarum*, published in 1727. With a modesty which formed not the least striking characteristic of this amiable man, he attributed the invention to Papin, because this individual furnished the idea of using the expansive force of steam to raise water, and from his having taken the four-way cock which Papin used in his air-engine.

In 1802 Messrs. Trevethick and Vivian, of Cambourne in Cornwall, took out a patent for a high-pressure engine, which was used to propel a carriage or wagon: the arrangements of this engine are particularly ingenious, and some of the details modified, form features in many of the modern high-pressure engines.

From 1804 to 1840 the improvements in the steam-engine were marked indeed. In all parts of the civilized world manufacturing and commercial demands upon steam were continually increasing. This necessitated constant improvements in the construction of the appliances and

those, who, in various ways, contributed to the advancement made in this direction are too numerous to mention.

Although great changes were made up to 1840, it has really been since that time that the greatest improvements have been inaugurated, since the discoveries of James Watt have been given to the world.

The crude and imperfect devices of fifty years ago have gradually been displaced, from time to time, until today we have a most wonderful and intricate system of steam appliances.

We can, perhaps, gain a more satisfactory and accurate history of the progress of this work in the last half century by a careful review of the prominent manufacturers of steam appliances and the results of their labors, which we find in another portion of this book, and to which we will address our attention after considering the steam plants and their engineers as they are today in the city.

LEADING ENGINEERS.

MR. GEO. E. STAFFORD, the engineer in chief at the State House, was born in Woonsocket, R. I., in 1848, where he attended the public schools, graduating with honor. He served his time with the Union Worsted Company, where he was connected for four years, from which place he went to the Harris Woolen Company as engineer, remaining with them some time. He resigned this position to assume the entire charge of the steam plant of the Lippett Woolen Company, where he continued his labors until the tenth of June, 1875, when he resigned and entered upon the duties of his present position, which he has so acceptably filled for the past eleven years. On coming to the State House, he found they were running on high pressure, and the steam service, as a whole, was very unsatisfactory.

He soon changed all this, and to his management is due the high position which the steam system at the Capitol Building has now assumed. The service is on low pressure, and consists of a forty-five horse power regular Corliss engine and three eighty horse power Whittier boilers, one Sturtevant blower with a six foot fan, exhausting thirty-five thousand cubic feet of air per minute, also one engine for the incandescent electric lighting apparatus, consisting of some one hundred lamps. To the work required of the service is the heating of the one hundred and seven rooms in the building, and

about sixty rooms in the Commonwealth Building across the street, which is connected by five hundred feet of pipe. To supply this plant with fuel requires from eight hundred to one thousand tons of coal per year.

Mr. Stafford was at one time with the well known N. P. Dawley, and is one of the most prominent engineers of Boston, being the chairman of the Board of Directors of the American Society of steam engineers.

THE steam apparatus at the Tremont Temple building is in charge of MR. THOMAS J. MAW, who was born in Montreal, August 26th, 1861. The first few years of his life were occupied much like those of other boys in attending school and devoting his spare time to the games and past-times which boys so much enjoy. When about fifteen years of age, he evinced a desire to become a machinist, and served three years at the trade. At the end of that period, he assumed charge of one of the large engine and boiler works near Montreal, where he remained for three years, during which time he was called to the States for the purpose of superintending the steam fitting of a large factory then in process of erection on the Cape. When this work was completed, he made arrangements whereby he remained and assumed entire charge of the department. From here, feeling a desire to become situated in some larger place, he went to assist the Brush Electric Light Company in establishing their plant at Nantasket, after which he returned to Boston and took charge of several large engines on the Back Bay. Some two years ago, being offered the position which he now occupies, he resigned his various other charges to this end.

The system with which Mr. Maw is connected consists of one eighty and one forty horse power boiler, and one fifteen horse power engine which drives a twelve foot fan for ventilating the building. There is also one double upright twenty-five horse power engine which runs the elevator and three Blake pumps for feeding the boilers.

He is a member of Washington Lodge No. 10, and Uniform Rank Division No. 4, Knights of Pythias, is connected with a literary society and with one of our cornet bands. He is probably the youngest engineer in full charge in the city, and has a bright future before him.

MR. ADAM HAGARTY was born on May 23d, 1852, in Waterford County, Ireland. When about eighteen years of age he concluded to join a company of his friends who were about to seek their fortunes in the new world, and first went to New Brunswick, where he learned his trade in one of the large boiler works of that place.

At the end of three years, thinking to better himself, he accepted the position of fireman on the "New England," one of the boats of the International Steamship Line, and was on her when she was wrecked on that memorable night. He remained with this company over two years, then tiring of steamboat life, came to this city and accepted the position of chief engineer of the Richardson Building, No. 178 Devonshire Street, where he now is.

In politics Mr. Hagarty is a Republican, and takes a lively interest in the welfare of his country. He is a member of the "American Legion of Honor" and an Odd Fellow in good standing. The service which he so admirably superintends consists of two sixty horse power boilers, one forty horse power Brown engine, and one Worthington duplex

pump on the sprinkler system. Four elevators and five large printing establishments receive their motive power from this plant.

Mr. Hagarty is a most genial man and an honor to his position, which he has so faithfully occupied for the past twelve years.

THOMAS QUINN, was born in County Cork, Ireland, in 1842, coming to this country when a mere child, and entering the public schools where he proved an apt and diligent scholar. When but a young boy, he manifested a strong love for the sea, and as soon as possible entered upon the duties of an engineer of the Merchant Marine, where he remained eleven years.

When the war broke out he entered the navy, being connected with various boats, among which were the United States Steamships, "Ino" and "Pautuxet."

On his return, he was prevailed upon to assume charge of an engine in the Navy Yard, where for three years he rendered most acceptable service. At the close of this period, he entered the morocco works of G. S. Hall & Company, where he was chief engineer for nine years. He then returned to the Navy Yard and occupied his old position until about three years ago, when he took charge of the steam system at the Boston Journal Office where he now is. In politics he is an Independent, and votes for whom he considers the best man.

The plant in his charge consists of two sixty horse power boilers; two forty horse power engines for general work; two fifteen horse power Whittier elevator engines, one air and two feed pumps. Mr. Quinn is an efficient and conscientious man.

HENRY MEYER, Esq., chief engineer at the Boston Herald office, was born in Bremen Co., Germany, in 1840, where his boyhood days were spent. When about sixteen years of age, his ambition prompted him to seek his fortune in an unknown land, and he came to the States with a determination to make his mark in the world. He located in Cambridgeport and served his time with a tanner, one William Miller, and for eight years remained a valuable assistant to his employer. At that time the position which he now occupies was offered him, and for fifteen years he has continued his labors at this place, making many valuable improvements in the plant which is one of the largest in the city. Mr. Meyer says he is too busy to take an active interest in politics, nevertheless he is alive to all that transpires for the good and welfare of his country. At the time of the Rebellion he entered the navy, and as one of the boys in blue assisted in overthrowing the wrong and placing the right on the throne, being in the service two years, from which he was honorably discharged.

He is a member of Lodge No. 2006, of the Knights of Labor, and is interested in all that pertains to the improvement of his fellow men. The system of which he is chief consists of two sixty and one eighty horse power engines; one three hundred horse power boiler, four pumps and three Sturtevant blowers, two four feet, and one three feet in diameter. Mr. Meyer is considered one of the best engineers in the city.

J. H. KAZAR, Esq., was born in Williamantic, Conn., in 1842. Like most American boys he attended the public schools of his native place, and manifested a deep interest in his various studies. On completing his education, he

decided to become a machinist, and made arrangements whereby he served his time with Pitkin Bros., of Hartford. About this time the war broke out, and being a gallant son of his country, he entered the service of the First Connecticut Cavalry and went to the defence of his native land. He was in the army about three years, and at the close of the war came to Boston and accepted the position as chief engineer at the St. James Hotel, which was then in its palmy days. He remained there eight years, resigning to accept the entire charge of the steam system in the large and magnificent pile known as the Equitable Building, where for twelve years he has ably conducted this great plant. The service consists of three twenty-five horse power hoisting engines built by McAdams & Cartwright, of New York, two steam pumps, four fifty horse power boilers, and one Blackman wheel, four feet in diameter, exhausting twenty-five thousand cubic feet of air per minute, which is used for ventilation.

He is one of the oldest engineers who run cable elevators in the city, the second one being constructed for the St. James Hotel, at which place he was at the time. Since assuming his present position, the service of the Equitable Building has continually improved, and to-day stands second to none in point of its efficient management.

Mr. Kazar is a member of St. Pauls Lodge of Free and Accepted Masons, and stands in the foremost rank of our engineers.

MR. A. C. BARONE was born in Remiis, Switzerland, 1844, where his boyhood days were spent. On coming to man's estate, he determined to strike out for himself, and

believing he could do well in this country, bid farewell to his native land and set his face toward the west.

On arriving in America, he found treason and rebellion rampant, and like a true man shouldered a musket and marched forth with the brave boys in blue, striking a blow for right and liberty. At the close of the war he laid down his arms and looked about for employment in his chosen work. Though a stranger in a strange city, one like Mr. Barone could not long remain without a position of trust, and soon that of chief engineer at Young's Hotel was offered him, where, for the past sixteen years, he has efficiently conducted this plant, and to him is due the credit for its present standard of excellence. It consists of three boilers, one sixty-five, one forty-five and one thirty horse power, also two elevator engines.

Mr. Barone is a mason and a member of the Knights of Honor. He is considered a most careful and efficient engineer, and with his years of experience is among the most prominent in the city.

WILLIAM JOHNSON, Esq., was born in Lincolnshire, England, in 1861, and remained about home until he was apprenticed to a machinist, or as they term it, a fitter. At this time he was only fourteen years of age, but his ambition to perfect himself in his chosen profession was such that he met with more than ordinary success, and proved such a valuable assistant that he remained five years beyond his serving time. He next went to Yorkshire, where he accepted a position on the Manchester, Sheffield and Lincolnshire Railway which he occupied two years. Fortune then directed his steps to America and the following March he secured passage on an eastern bound vessel. He had been in Boston but a short

time when he obtained a position at the Highland Foundry as machinist, later resigning in favor of his present position as chief engineer at the Advertiser Building. The plant consists of one Sturtevant fifty horse power engine, one fifty-five horse power boiler, one incandescent electric lighting machine ; one Blake air pump, one Knowles water pump, two Dame pumps, one Blackman wheel, four feet in diameter, one Shepard upright twenty horse power engine and one Whittier water elevator. Since Mr. Johnson has had charge of this system it has continually improved, and today is one of the best managed plants of Boston.

CLARENCE C. HANFORD was born in Redbank, Monmouth County, New Jersey, in 1839, and the first few years of his life were spent in the public schools of his native town.

When but a boy his people, desiring to secure better advantages for him, removed to Boston and placed him in the Chauncy Hall School where he remained until he entered the Institute of Technology. While in this well known institution of learning, he became especially interested in chemistry, and took a special course of study in that department. When the war broke out he entered the service and like a true son fought for his country. At the close of the rebellion, he received the following testimonial from the Government :—

Commonwealth of Massachusetts.

To Clarence C. Hanford, Co. A., Third Artillery and United States Navy.

The Commonwealth of Massachusetts honoring the faithful services of her sons who formed a part of the land and sea forces of the United States employed in suppressing the Rebellion and maintaining the integrity of the nation, has by resolve of

the General Court of 1869, directed the undersigned to present you this testimonial of the people for your patriotism. Granted at Boston the nineteenth day of April, in the year of our Lord one thousand eight hundred and seventy.

Signed: WILLIAM CLAFLIN, *Governor*.

J. A. CUNNINGHAM, *Maj. Gen.*

On his return from the war he entered the Eagle Sugar Boilers, where he occupied the position of chemist for eight years or until the panic of 1873, when this house was overtaken by the financial storms of that time. He then became connected with a brother in the construction of elevators. For eighteen years he has been interested in steam, and to him is largely due the complete system of which he has charge in the Simonds Building. The plant consists of two fifty horse power boilers, one double engine for the elevators, and a large heating apparatus of both high and low pressure, which furnishes the heat for the eighty-five rooms in the building from one hundred and eighteen radiators. In politics Mr. Hanford is independent, he is a member of John Abbott Lodge of Free and Accepted Masons of Somerville, and is one of the prominent engineers of Boston.

ONE of the most prominent names among our city engineers is that of MILTON G. WOOD, Esq. Mr. Wood, whose name is so familiar to those interested in the use of steam, was born in 1841, among the green hills of Vermont. In his boy-hood days he attended the public schools of Bridgewater, Windsor County, his native place, and at an early age gave evidence of his mechanical bent. While he prosecuted his studies with no less interest than others of his own age, nothing had the power to hold his un-

divided attention in so large a degree as work of an intricate mechanical nature. He was forever building a boat or an engine with some new contrivance of his own inventive mind; in fact, at fifteen years of age, in order that he might devote his whole time and attention to this particular work, he gave up school and entered the employ of Daniels & Raymouth at Woodstock, who were large manufacturers of cotton, woolen and paper machinery. He entered the 1st Vermont Regiment, Co. B., William W. Belton, Captain, and in May of the same year marched to the front with a brave heart and a strong arm in aid of his country. He was in many of the most important engagements, and at the close of the war returned with the knowledge and satisfaction that the work had been accomplished and the Union saved.

Mr. Wood had hardly doffed his uniform when he was offered a position on the Rutland and Burlington Railroad, at their works at Rutland, Vt. He remained here two years, when he entered the construction department of the Vermont Central Railroad as foreman, where he remained until he accepted the position in the same capacity on the New York and New England Railroad, here in Boston. For five years he occupied this position, and resigned to accept that of master mechanic for N. C. Monson, and with him was connected with the Back Bay improvements. Two years later he accepted the chief engineership of the Boston Post Office, where, on the eighth day of last September, he had been for the long period of twelve years.

The steam interest of which he had charge here is one of the largest in New England, consisting of two Porter Allen engines, one hundred horse power each, which furnish the motive power for the one thousand Edison electric

lamps, which light this great building; three hydraulic pumps which run six large elevators; one large rotary engine, which furnishes the power for two elevators, the printing office, and ten canceling machines for canceling stamps; one Sturtevant blower engine for ventilation, which exhausts twenty-six thousand cubic feet of air per minute; eight steel boilers, forty-eight inches in diameter, and sixteen feet in length; one large fire pump with four duplex steam cylinders connected with two thousand feet of hose and six hydrants on the roof of the building, each of which will throw an inch stream of water simultaneously. It can be readily seen that the knowledge and experience required for the direction and control of this vast system could be found in but few men, and among these few the name of Mr. Wood will ever be prominent.

In physique, Mr. Wood is finely built, of a sanguine temperament and a most genial gentleman—in fact a representative son of his native State. He has for the past ten years resided in South Boston, where he is interested in all that is for the public good, being one of the few who were instrumental in organizing the charitable institution which is incorporated as Dahlgren Hall, connected with Dahlgren Post 2, Department of Massachusetts, Grand Army of the Republic, of which he is a member. He is also President of the American Society of Steam Engineers.

Though a Republican in politics, he is not controlled by party lines, but casts his ballot for those whom he believes will serve the best interest of his country.

MR. EDMUND FRANK DREW was born in South Boston in 1856. He came from an old family of engineers, being the

son of Frank Drew, Esq., so well known to the last generation, and has two brothers in other parts of the States in the same line. For the first eight years of his life, Mr. Drew attended the public schools of this city, after which his father removed to Maine, where he continued his studies for a few years. As he grew towards manhood and manifested an interest in machinery, he looked about for a desirable place to learn the machinist trade. The result was that he apprenticed himself to the Woonsocket Machine Company, at Woonsocket, R. I., where he served his time. As time wore on, he became connected with the Globe Mills, under N. P. Dawley, where there were two Corliss engines of seven hundred horse power each. He remained here some three years, and resigned to accept the position of engineer with the Hopedale Machine Company, of Milford, Mass., where he remained a little more than a year. He then went to Benson & Nelson's, where he had charge of all the machinery of the plant. He remained in full charge here for three years, at a constantly increasing salary. From Benson & Nelson's, he went to Worcester with Washburn & Garfield, steam fitters, from whence he came to Boston and entered the employ of Drew & Coffin, with whom he remained for some time, from whence he went to the Walworth Manufacturing Company. At this time, while superintending the steam fitting of the building occupied by W. S. Butler & Co. on Tremont Street, Mr. Butler persuaded him to resign his position and assume the charge of his establishment here. Upon due consideration he concluded to make this change, and accordingly did so. When he assumed the charge of Mr. Butler's plant, it consisted of only one small engine, and he had occupied his new position but a short time

when he discovered that something must be done to ventilate the building. He forthwith conceived a system which for its simplicity of construction and the character of its work could hardly be improved. It consists of a forty-eight-inch Sturtevant blower, which is connected with a system of conductors, which discharge from fourteen registers 31,982 cubic feet of air per minute, which is changed every eight minutes. Some time later he introduced one of Prof. Sweet's straight line engines for running an electric lighting apparatus, which, by the way, is the only one in the city used for that purpose. It is forty-eight horse power, and makes two hundred and sixty-five revolutions per minute. He uses the Thomson-Houston arch and incandescent systems of lighting, and has also introduced a Wainwright, one hundred horse power steel heater. He runs this whole plant with only one small boiler, forty-eight inches in diameter and sixteen feet in length. He has occupied his present position as chief engineer for the past four years, and is one of the best in the city.

GEO. H. GRUEBY, engineer in chief at the City Hall, was born in 1844 in the north part of the city, where he attended the public school until he began to look about the world for himself. Thinking the trade of a machinist would be to his liking, he made arrangements with the management of the well known Atlantic works, and served his time with them. On completing his labors at this place, he became connected in East Boston, where he remained until offered a position at the bending mill in the Navy Yard, which he occupied several years, resigning in favor of the Waltham Manufacturing Company. He was at these well known works until 1876, when he was prevailed upon to assume

full charge of the steam plant at the City Hall, where for the past ten years he has so ably been connected.

Mr. Grueby has had a long and varied experience in the service of steam, and occupies the position of Vice-President of the American Society of Steam Engineers.

The plant at the City Hall consists of four boilers of one hundred and seventy-five horse power, two engines and one Sturtevant blower, which furnishes six thousand cubic feet of air per minute for the Council Chamber. The Court House is connected with the City Hall plant, and to furnish them both with heat and power requires only about six hundred tons of coal per year. Mr. Grueby is one of our most prominent engineers.

A. L. BARNES, Esq., engineer in chief at the Mason building, Liberty Square, was born in South Hampton, February 12, 1844, where he attended the public schools, later going to the village high school of Westfield for a few terms.

He began work at an early age on the farm, but this was little to his liking, so he secured a position in the village grocery store. He had not been long in the practical workings of a small country shop when he became restive, and as the war had just broken out, though but a boy of eighteen he enlisted, being enrolled on the twenty-fourth of September, 1862, in Company C Forty-sixth Massachusetts Volunteer Militia, and for nine months was in active service. On his return, he went to Northampton, temporarily, as a watchman at the Insane Asylum, after which he was induced by a friend to become connected with a broker with whom he had hardly become acquainted ere he left the town one dark night forgetting to pay his clerk his week's wages. This proved, however, to be a blessing in disguise, as in a short time he was in the employ of a large wool house who, recognizing his ability,

sent him to Hartford to superintend their interests at that place. From there he returned to Westfield, once more trying the grocery trade, but his ambition for a more active life soon led him again into the world, where he became acquainted with some fitters who were piping a building, and seeing a pair of pipe tongs concluded to look for a situation in that line.

He was soon in the employ of Pitkin Brothers and Company, superintending their work until the Rhode Island Steam and Gas Piping Company offered him a position which he occupied one year. After this he became connected with the world-renowned H. B. Smith Company, of Westfield, for whom he was on the road about three years. He next borrowed one hundred dollars of an uncle with which he secured a half interest in a kit of pipe tools, by which he was enabled to contract for repairing the Globe Theatre building in Boston, after which he was offered the position as engineer of the plant remaining until the great fire. He then took a half interest in a machine shop in Westfield, which from previous bad management had continually depreciated. Here he remained five years battling against fate, finally making arrangements to conduct the business alone. He was connected with many important enterprises, among which were the Capitol at Albany, N. Y., Wellesley College and the Mason building of this city, on the completion of which he assumed charge of its steam system April first, 1881. In politics Mr. Barnes is a Republican, a member of Mount Moria Lodge of Free and Accepted Masons of Westfield, and a member of Post No. 7, Grand Army of the Republic.

The Mason building contains eight hundred thousand cubic feet requiring heat and power, which is furnished by one twenty horse power engine connected with a large ten foot Sturtevant fan constructed especially for the building, which

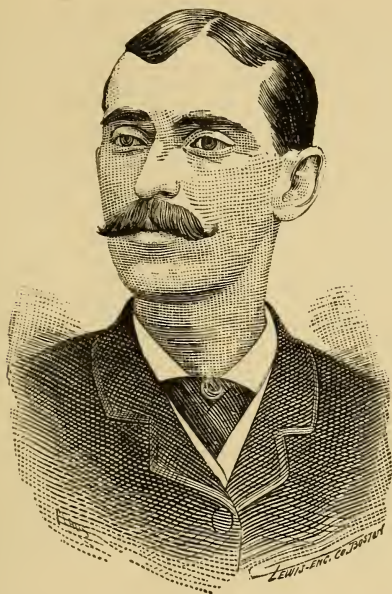
displaces five hundred thousand cubic feet of air per minute. One fifteen horse power boiler for heating purposes ; and two one hundred horse power boilers for general work.

Mr. Barnes is a genial gentleman and occupies a high position in the estimation of his fellow engineers.

MICHAEL DUNLAP was born in Northumberland, N. H., in 1852, where his youngest days were spent, although his education was mostly acquired in Maine, where his people were soon located. When about fifteen years old he came to Boston, thinking the chances in a large metropolitan city would be to his advantage, and securing a place in one of the large machine shops, he served his time at steam fitting.

For several years he was connected at various times, with some of the best known firms of the city. In 1875, he was offered the position of fitter at the Whittier Machine works, and for over five years was a valued employé. Resigning this position he accepted that which he now holds as engineer at the Adams House, where he has been the past four years. In politics he is a Democrat, but never allows party feeling to surmount his personal convictions, and is a member of Prince Lodge, No. 128, Legion of Honor.

The plant of the Adams House consists of two twenty-five horse power Whittier elevators, one Ryder Horizontal twenty-five horse power engine ; two fifty-four inch boilers ; one Knowles pump, number three ; one Sturtevant blower, four feet in diameter, and one small Blackman wheel. These furnish the heat, power and ventilation for the three hundred rooms in the building, and the efficiency which Mr. Dunlap has displayed in his management, places him among the first engineers of the city.



MR. GEO. W. HOWARD was born in 1857, in Woburn, where he attended the public schools until he began work at the early age of fifteen, entering the employ of Burrell & Co., of that place, where he served about three years. After finishing there he secured a small engine which he run until he became interested in the milk business, in which his success was such as to lead him to secure an interest in a Chelsea express route. This, however, was at the time of the financial depression of seventy-three, and among others this undertaking was overthrown, and he was forced to begin life anew. He returned at once to his trade, and for three years was interested in various steam plants, when he obtained the position of fireman, under S. B. Adams, of the New England & Weston Electric Light

Company. At the end of three months he was promoted to engineer, and assigned to the Eastern Avenue Station, to relieve the first and second assistants, at which place he was connected with one pair of one hundred horse power Buckeye Engines, having a speed of one hundred and fifty-three revolutions per minute, and one pair Hawkins Engines of fifty horse power per side. After a time this station was closed, and the company in reducing their help placed him in the Stanhope Street Station as second assistant. When he had been there about fourteen months he decided to make some change, owing to a personal unpleasantness which had arisen with his superior, and, through the influence of Mr. Adams, he secured the position of chief engineer at the Merchants' Electric Light Station, where he remained over two years, resigning to accept a position offered by the Rhode Island Locomotive Works, at Providence. He had been there but seven months when the large manufacturing establishment of G. E. Barstow & Co., sent to them for a supply on account of the sickness of their own engineer, and he was accordingly detailed to do the work. His services were so satisfactory that arrangements were made which resulted in his assuming full charge of this large plant, which consists of a four hundred horse power Harris Corliss Engine, and nine hundred horse power boilers, constructed by the Rhode Island Locomotive Works. Mr. Howard's experience has been extensive and varied, and he has been connected with some of the largest plants of New England.

MR. A. GUILLIFER was born in 1842, in Bangor, Me., where he availed himself of the opportunities offered by the district school until he was fourteen years of age, when

he began to work for himself. He served his time in one of the large machine shops of Portland, after which he entered the service of the merchant marine on one of the boats of the International Steamship Company plying between Boston and St. John. He was connected with this company for the long period of thirteen years, working up from fireman to engineer. In 1861 he entered the service of the navy, being eighteen months in the steamship Colorado and thirteen months in the Passoitte, from which he received an honorable discharge. Through the influence of a friend some two years ago, he came to this city and took charge of the steam plant at the Pavilion of Houghton & Dutton, on Tremont Street, where he has conducted his work with marked efficiency. Though his old position is still open to him at any time, he has become interested in his system here, and continues his valuable improvements. He is of a philanthropic disposition, has been connected with the Odd Fellows for six years, is a member of the Grand Army of the Republic, J. A. Hawes Post 15, of East Boston, and is prominently connected with the Society of Marine Engineers.

F. A. P. Cox, Esq., was born at Blackberry Station, Kane County, Ill. His people soon after his birth removed to Cambridge, where he attended the public school until he moved to Chelsea, where he completed his education. When but a young man he decided to visit his birthplace and accordingly started for the West. While in Cleveland, Ohio, he had the opportunity of seeing considerable machinery and became so much interested in the work that he made arrangements to serve his time, staying, however, five years. His thoughts being frequently on the East, and

his friends in this part of the country, he decided to resign his position and return home. On coming to Boston, he engaged in the tin business on Commercial Street, where he was connected about a year. In 1883, he was secured by the Weston Electric Light Company as assistant engineer of their Stanhope Street Station, and on the resignation of Mr. Adams, was promoted to the position of engineer in chief.

The plant consists of one pair of two hundred horse power Buckeye engines; two Armington & Sims four hundred horse power engines; four seventy-two inch shell boilers sixteen feet long, one Weston thirty horse power engine, one Davis pump, one Berryman heater and two Hancock inspirators. This system controls over fifty dynamos which supply one thousand electric lights. Mr. Cox is one of the most able engineers in Boston, and has a bright future before him.

MR. ROBERT THOMPSON was born in 1848, in Romeo, Mich., from whence his people moved to the South when he was a mere child. The first few years of his life were spent in Morgan City, La., from which place they again moved, going to Hartford Conn., where he entered the public schools, studying until he began work for himself.

When the war broke out he showed his patriotism by entering the Twelfth Connecticut Regiment, with whom he met the enemy in many important engagements. At the close of the Rebellion he came North, and after being here sometime, was so much pleased with the place that he concluded to remain. Having previously served his time in Hartford, with the well known H. P. Blair, with whom he was connected over four years, his services were soon in demand by Walker, Pratt & Co., where, after being seven

years, he resigned to assume charge of the extensive work conducted by Brayman & Dow, staying there five years when he was persuaded to resign in favor of Wright & Moody, where he has been for the past year. Mr. Thompson has one seventy-five horse power engine, two sixty horse power boilers, and one number four Knowles pump. He is considered a most efficient man and holds an enviable position among his fellow engineers.

MR. E. H. WILSON was born in St. George, Knox County, Maine, in 1842, where he attended the district school during the winter months, and worked on the farm in the summer.

He was naturally of an ambitious disposition, and though cheerfully performing the duties required of him from day to day, his mind was always active in acquiring knowledge of a mechanical nature. As he grew toward manhood, his inclination led him to try the sea, and for a few years his life was first that of a seafaring man, and then a farmer. Tiring of this, he came to Massachusetts, going to Worcester, where he entered a machine shop, serving two years, from which he went into the navy as an oiler on the steamship Saco, which was guard ship at Fortress Monroe. At the close of the war he returned to Boston, and served two years at steam fitting, after which he went as night watchman to the Hallett & Davis Piano factory, where he remained until two years later, when he resigned to go as night engineer to the great pork packing establishment of John P. Squire & Co, at Cambridge, and later was connected with the Cambridge Rolling Mills two years. On completing his engagement there, he went to Rockland, Me., as engineer in a large grist mill which had just been

erected, where he remained about three years, after which he went to Dix Island, and was engaged in cutting the stone for the New York Post-Office, then in process of erection. At this place he had charge of the first steam drill used in that State, and later was at Hencon Island in connection with the St. Louis Post-Office and Custom House work, after which he returned to Rockland, remaining about one year. At this time the work for the Albany Post-Office was in progress at St. George, his native place, and here his services were soon in demand. On finishing this engagement he returned to Boston and resumed his work with the Hallett & Davis Piano Company, after an absence of fifteen years.

In politics he is a strong Prohibitionist, being a member of the Ward and City Committee of Ward Twenty, and is always at the front in the cause of temperance. He is a member of the Rockland Lodge of Free and Accepted Masons, of Rockland, Me., and is prominently connected with the Independent Order of Stationary Engineers.

The plant of which Mr. Wilson has had full charge the last five years, consists of one pair side valve fifty horse power engines, one pair one hundred horse power boilers, one Blake and one Dean pump, a Davis power pump for feeding the boilers, an artesian well with a Davidson pump attached, and a full equipment of automatic alarms, pipes, hose and fire extinguishers.

The building contains six miles of steam and gas pipe, and in its management is among the first plants of the city.

MR. D. F. KILGOUR was born in Boston, in 1863, where he attended the public schools until he was thrown on his own resources. Fortune directed his steps toward a steam-

fitting establishment, where he served his time, completing it in a little less than three years. He has been connected at various times with some of the best known firms of the city, among which may be mentioned Mudge & Joy, Jordan, Marsh & Co., The Walworth Manufacturing Company and the Commercial Manufacturing Company. Much of his time has been spent in the engine rooms of pleasure boats, many of the most magnificent having been in his charge. In this service he is very successful, and his wide experience and general information place him in the foremost rank of those who make this department of steam work a specialty. Mr. Kilgour, at present, has charge of the plant at the Music Hall building, which consists of three boilers and two engines. He uses a Hancock inspirator and all modern improvements, and much credit is due him for the excellency of the system under his control.

MR. G. S. KINGSBURY was born in Keene, N. H., in 1830, where he worked on the farm and in the mills, acquiring, in the meantime, what education he could. On coming to Boston, he secured a position as fireman, and for some time continued in that capacity, but one of Mr. Kingsbury's ambition could not long remain at this work, and he was soon given full charge of an engine with Rawson & Hidgen, with whom he remained seven years, resigning to accept charge of the system of the Old Boston Wheat Bread Company, with whom he stayed three years, from whence he came to his present position, which he has so ably filled the past ten years. The plant of Codman & Shurtleff, of which he has full charge, consists of one fifty horse power Hollis engine, one fifty horse power Whittier boiler, two Blake pumps, one Ashcroft plunger, one Sturtevant blower,

six feet in diameter, and one of the new Baragwanath feed water heaters and purifiers, which is the second one in the city, and which Mr. Kingsbury was instrumental in introducing into Boston.

MR. HENRY M. WEST was born in 1830 in North Bridgewater, and is a genuine Bay State boy. The schools at that time were the usual district institutions, and he availed himself of all the advantages they offered until he was eight years old, when he began work. At that early age he was quite a little shoe-maker, working at his own small bench until he was sixteen, when he was apprenticed to a carpenter. This, however, was not at all to his liking, and three years later he negotiated with the world-renowned Corliss, of Providence, which resulted in his serving five years at these works. While there he was sent to Fall River to place one of their large engines, and on the completion of his work was persuaded to remain and continue in full charge of the plant, which he did until the destruction of the mills by fire; afterward he took down the engine, repaired it, and placed it in the new building, continuing to run it some three years. He then returned to Providence assuming charge of one of the extensive plants of that city for thirteen years; from there he went to Walpole, staying two years, when he was secured by the New York and New England Railroad, with whom he remained over five years. He resigned this last position to assume full charge of the plant of R. Hollins & Co., which task he has so ably accomplished. The system consists of a fifty horse power Brown Engine and a one hundred horse power Cunningham boiler. He has also been connected with the Old Colony Railroad, and was at one

time in Brockton thirteen years, being obliged during the whole period to stop his plant but forty-five minutes. He is an Odd Fellow and a member of the National Order of Steam Engineers, and in the capacity of a locomotive or stationary engineer, Mr. West is most efficient, and his is one of the prominent names of the city.

MR. S. C. SPAULDING was born in 1843, in Concord, N. H., from whence his people removed to South Carolina, while he was but a small child. When a young man, he entered a large machine shop in Charleston, that State, where he served his time, on the completion of which he secured a position on one of the railroads in that section. Being in Florida when the war broke out, he entered the Southern army, and was in most of the important engagements, being in Kentucky, Tennessee and Mississippi, and forming one of the number on the memorable march through Georgia, serving in the Third Florida Regiment. At the close of the Rebellion, he assumed charge of a stationary engine, and for three years remained in the South, at the end of which period he went to Westerly, Conn. When his labors here were completed, he was secured by the Aetna Cutlery Company for their works at New Britain, with whom he remained about one year. He then returned South for a short visit of four months, after which he was engaged in various places in setting up some of the largest plants in the New England States.

He next came to Boston and went with N. Cummings & Co., on Albany Street, where he rendered valuable service for the long period of ten years. From Mr. Cummings' he went to the Commonwealth Hotel, then accepted his present

position of engineer in chief at the well-known works of Morton & Chesley. In politics Mr. Spaulding is a Democrat, and is a member of Harmony Lodge, No. 42, of Free and Accepted Masons, of Waterbury, Conn., a member of the Knights of Pythias, and of the Knights of Honor, and is prominently connected with the Independent Order Number Three of Steam Engineers. He has one seventy-five horse power Whittier Engine, two ninety horse power Whittier boilers, and one Hancock inspirator. He is prominent among the engineers of the city.

W. H. MATHERSON, ESQ., engineer in chief at the New England Homœopathic Hospital, was born in 1839 at Scituate, R. I., where at an early age he began work, which necessarily crippled his opportunities for an education. He worked at various things until he obtained the position of fireman on one of the trains of the Providence and Stonington Line, where he remained over three years. By this time he had become so much interested in steam appliances that he determined to learn the trade of a machinist, and to that end resigned his position and entered the machine shop of the Hope Iron Company, serving four years, after which he was offered the position of engineer at the large flouring mill of Roger Williams, where he assumed full charge of a two hundred horse power Corliss Engine. From there he went on the road, constructing and setting up engines all through the British provinces and in the West. When he had completed his labors in this direction, he returned to Providence and assumed charge of the plant at the Pascome Woolen Mills, where he was connected two

years, resigning to accept the position of engineer at the large ice works of that city. On finishing his work there he was secured by the Auburndale Watch Company, remaining with them four years, when he took the position at the Commonwealth Hotel, where he was connected two years. The New England Homœopathic Hospital being about completed, the management began to look about for an engineer, and learning of the whereabouts of Mr. Mather-son, secured him at once, and for three years he has efficiently conducted this plant, making many valuable improvements and contriving many new devices for the saving of fuel. He has a large and valuable library on steam and kindred subjects, and his knowledge of its principles is most thorough. He is independent in politics, and for fifteen years has been connected with the Odd Fellows, is past president of the National Society of Engineers, being one of the charter members of this body. He has two boilers, two engines, two Davidson pumps, and the Tudor differential system of heating. He is one of the best engineers in the city.

MR. A. E. PHILLIPS was born June 13th, 1833, in New Salem, where he obtained what little education he could at odd moments. He went to work at an early age, and was interested in one thing and another until he entered the machine shop to serve his time, after which he obtained a situation with Frank Coffin, where he remained about one year, when his services were secured by L. H. Dwelley, with whom he was connected for over thirteen years. After completing his service here, he entered the employ of

James & Co., with whom he was associated about the same length of time. He next entered the barrel factory at South Boston as chief engineer, remaining three years, but while there he became acquainted with Mr. G. H. Miller, and was secured by him for his plant where he remained until he accepted his present position, which he has occupied the past six years, making many valuable improvements. The system consists of four twenty-four horse power Whittier elevator engines, two upright horse power boilers, one sixty horse power horizontal boiler, and a Hancock inspirator.

In politics, Mr. Philips is independent; and a member of Gate of the Temple Lodge of Free and Accepted Masons, St. Mathews Royal Arch Chapter, where he has taken the thirty-second degree. He is a most efficient chief, being one of the oldest engineers in the city, and is located at 68 Chauncy Street.

J. T. SIDERS, ESQ., was born at Hingham in 1841. The schools at this time offered only the usual district advantages, and it was here that Mr. Siders received his first instruction in the rudiments of the three Rs, "Readin, Ritin and Rithmetic." When sixteen years of age, he went to work for himself, entering the establishment of the Hingham Cordage Company, where he served his time, remaining two years. Then his health began to fail, and his physician ordered a sea voyage. Shipping for California, he was scarcely afloat ere he began to feel improved, and for eight years followed the sea, during which time he visited nearly all parts of the world. Being now twenty-six years of age and in robust health, and thinking he could well stand the confinement of his old occupation, he

returned to Hingham and assumed the position of engineer at a large box factory. He remained two years, resigning to connect himself with Vaughn's shoe factory at Abington, where he remained some length of time. After that he went to the Hingham Jute and Bagging Company, where he rendered most acceptable service for over five years; then going to Brockton, he had, for three years, charge of one of the largest engines in the place. From Brockton, he went to Plymouth with Fred Jones & Co., and after conducting their system about two years, entered the service of the Old Colony Railroad, where he had been connected but a short time when he received injuries which compelled him to resign, and it was some time before he was again able to do anything. On recovering his health, he was secured by John Stetson, of the Boston Job Print, as night engineer, but he had hardly begun his labors when the management of Hotel Nantasket offered him full charge of their steam plant, and for two seasons and one winter he ably performed these duties, resigning to enter the service of the Brush Electric Light Company, with whom he was connected over two years.

He was then secured by Mr. F. L. Ames and placed in full charge of his system, where he has been for the past four years. Mr. Siders is a member of the Old Colony Lodge of Free and Accepted Masons, and he has taken the thirty-second degree, he is also an Odd Fellow connected with Bethesda Lodge.

His plant consists of two fifty horse power boilers, four twenty horse power elevator engines and a Hancock inspirator. He is located at No. 77 Chauncy Street, and is one of the ablest men in the service.

MR. W. B. DESMOND was born in Boston in 1858, where he attended the public schools until fifteen years of age, at which time he began life for himself. He first entered the works of the Walworth Manufacturing Company, where he served seven years, resigning his position with them to accept a more lucrative one with A. B. Franklin & Co., with whom he was connected two years. From there he came to the well-known lumber house of W. H. Leatherbee & Son, where he has rendered most efficient service for the past three years, doing his own fitting, and making his own repairs. In politics he is, as he expresses it, a "Mugwump," and is connected with the Knights of Labor. Mr. Desmond's plant consists of one sixty horse power boiler, one twelve and one sixteen horse power engine, and a Hancock inspirator. He is one of the young engineers of the city, and has a promising outlook in life.

MR. D. D. POOLE was born in Boothby, Me., in 1843. He was placed in the public schools until he was twelve years of age, when he left home dependent on his own resources. Being naturally of an ambitious disposition, he started out in life with the determination to succeed, and until nineteen years old turned up a dollar wherever he could. At this time he had an opportunity to learn steamwork and continued in the same until 1861, when he entered the navy in the service of his country being on the Tohoma, Colorado and Cherokee as fireman under Butler & Porter. At the conclusion of the war he went into the Merchant Marine in a coasting way, where he remained as engineer until 1866. On his return to Boston he became connected for three years, with Demo & Roberts, afterwards the American Steam Safe Company, after which he was in

South Boston about the same length of time. When his labors here were completed, he assumed charge of some large marble works where he remained until severely burned, when he went to Wright & Potter's, the State Printers, being there at the time of the Boston fire. For a few years after this he was interested in various steam plants, until he assumed charge at 28 School Street, where he remained seven years, when he became connected with the plant of the Boston Daily Advertiser, and later of R. H. White & Co. He came to Sargent Block, No. 33 Lincoln Street, about six years ago, since which time this plant has assumed a position of great excellency. Mr. Poole is a member of Palestine Lodge of Free and Accepted Masons of Everett, St. Andrews' Chapter of Boston, an Odd Fellow, and is prominently connected with Post 15 of the Grand Army of the Republic. His plant consists of one forty horse power Harris Corliss Engine, two fifty horse power Whittier boilers, and a Blake and a Knowles pump. He supplies power for fourteen elevators, and for as many buildings on South and Lincoln Streets. Mr. Poole is a most efficient engineer.

MR. J. H. WILSON was born in St. George, Lincoln County, Me., where he attended the district school until he began work for himself. He is descended from one of the oldest families of Maine, and, like many an other boy of the Pine Tree State, tried his fortunes on the sea. Being ambitious to see the world, he went from one place to another, visiting in his travels nearly all the important places on the globe. He followed the sea for eight years, rising from a

green hand to first mate of a first-class bark, and his experience, both in deep water and coasting, has been varied indeed. In 1857, he went to Michigan, where he remained during the winter, learning the trade of mason in the spring, but when winter came again being obliged to remain idle or seek some other means of a livelihood, he entered a machine shop in Worcester where for about three years he served his time. In 1863 he came to Boston to take charge of the engine of Holmes & Blanchard, but at this time the country was in turmoil and strife, and Mr. Wilson's heart was fired with patriotism, so he decided to make an effort to enter the service, and though he had previously been rejected, he succeeded in getting into the navy after which he found he was out of order and accordingly awaited word from Washington, the arrival of which found he had already sailed on the United States steamship Saco, of Admiral Porter's fleet. As soon as possible he reported on the Powhatan for examination and was assigned as third assistant engineer on the Crusada, which was attached to the flotilla of the Potomac. In March, 1865, this boat going out of commission he was detailed to the Nansamond of the same fleet, under Captain Baker, serving until she finished her work in the following August. He was then ordered to report at the Charlestown Navy Yard on waiting orders, where he remained until the general order mustering out all volunteers was given. At the close of the war he went into a machine shop, after which he secured the position as engineer in chief of the old steel rolling mill which at that time stood on the site now occupied by the F. L. Holmes furniture factory, remaining with them until they went out of business. He then returned to his old position in the machine shop, leaving the second time to go to the American Tool Company, being connected with them

until he went to the piano factory of Hallett & Davis, where he remained eight years. At the end of this period he was secured by J. E. Paul & Co., as master mechanic of their extensive plant. He next went with the well-known house of Brayman, Dow & Co., and was later connected with Morton, Chesley & Co., where he went to take charge of their new mill, after which he returned to the Hallett & Davis piano factory, remaining two years. He was then secured by the William Carleton estate, located at 30 Beach Street, to take full charge of their plant, where he has been the past five years, continually improving the service and most efficiently conducting the work. He is a member of Tremont Lodge and Massasoit Encampment of Odd Fellows, and is prominently connected with the Independent Order of Steam Engineers, being one of the pioneers of that lodge. The plant here consists of one large Corliss engine, 14 by 30 stroke, making three hundred piston feet per minute, and a seventy-five horse power boiler. Mr. Wilson has made many valuable improvements in his system, among which may be mentioned the reduction of fifty per cent in his coal consumption, with even better results than before. He is one of the most prominent engineers of the city.

SYLVANUS M. RUGGLES was born in 1822, in Providence, R. I., where he attended the public schools and worked on the farm until a young man.

Desiring to see more of the world and looking forward to a larger sphere in life, he learned the trade of a painter, serving some two years. This, however, did not seem to be to his liking, and he made arrangements which enabled him to become connected with the New York line of steamboats, and in a short time he was firing in the boiler room. When

he completed his engagement there, he was offered a large engine in a well-known lumber dressing mill, where for three years he had full charge. People were then turning their thoughts toward the South, and, desiring to see this section of the country, he went to Florida, while there taking an engine on one of the boats on the St. John's River, where he remained two years, after which he returned North, going in the winter of 1858 to the Barrows Woolen Mill in Dedham, where for the long period of fourteen years he occupied the position of engineer in chief, resigning finally in favor of Chase & Co., manufacturers of confectionery, at the corner of Kneeland and Washington Streets, where for the past ten years he has most successfully been connected. The plant here consists of one eighty horse power Putnam Engine, two sixty horse power boilers and one Knowles and one Davidson pump. Mr. Ruggles is a Republican in politics, and one of the leading members of the East Dedham Baptist Church, of which he is a director, and is one of the prominent men of Dedham, where he resides, holding a high position in the estimation of his fellow townsmen. He is one of the oldest engineers in Boston.

MR. D. J. CATTAM was born in Nova Scotia in 1833, where his boyhood days were spent. The schools at that time afforded but limited advantages; however, he received the same instruction as others until he began to work for himself. Being of a venturesome disposition, he concluded when a young man to try his fortune in the States, and accordingly came to Boston and began to look for employment. His first connection was with the East Boston Linseed Oil Works, where he remained in a general way until 1859, when he was given charge of the engine, which

he run for over ten years. He was afterward with A. K. Young & Co. for sixteen years, and in this long period was absent from his post of duty only five days and a half, and then on account of sickness. About this time the Columbia Rubber Company was organized, and Mr. Young being interested in the new departure as one of the company, he came here, where, since their organization, he has had full charge of the steam system, which consists of one seventy-five horse power boiler and a twenty-five horse power engine. Mr. Cattam is a member of the Royal Arcanum, and of the Ancient Order of United Workmen.



Mr. J. H. Blanchard, the engineer in chief at the American House, was born in the city of Cambridge, but when only three years of age his people removed to Merrimac, N. H., and, though born in Massachusetts, his early recollections

are of the old Granite State. He attended the town school until he was ten years old, and then, while a mere boy, began work for himself. He learned the trade of a wood turner, and some time later worked at the cabinet business, in fact turning up a dollar wherever he could find one ; but tiring of this, he concluded to try railroading and obtained a situation on the Lowell Railroad as brakeman, and being naturally of a quick and affable disposition, was soon in the line of promotion, and in a few years was given charge of an engine. From the Boston and Lowell, he went on the Manchester and Lawrence, where he remained some three years, resigning to enter upon new duties at the American House. He had occupied the position but a short time, when the management of Young's Hotel secured his services.

In a few weeks his absence became so great a loss that arrangements were made whereby he returned to the American House, where for the past seventeen years he has continued in full charge.

The service here consists of two forty, one ten and one twenty-five horse power engine ; one twenty-eight horse power boiler, and one Knowles fire pump, throwing one thousand gallons of water per minute. Connected with the house is a fire brigade which has attended eight fires, and succeeded in extinguishing four of the number unaided by the city department. He is the original inventor of what is now called the "Peerless Grate," which has proved such a valuable invention. He is an Odd Fellow and a member of the American Society of Steam Engineers.

Mr. Blanchard has accomplished a great work, and has been in the service of steam for many years.

J. T. F. SAUNDERS, ESQ., was born in Manchester, England. Coming to this country when quite young, he entered the public schools of Boston, where he remained until he was thirteen years old, when he went to work for himself, serving his time in the machine shop of J. B. Jaquith & Co., where he remained six years. He was naturally a mechanical genius, and in his work was very thorough and painstaking, giving particular attention to that which was most delicate and intricate in its construction. On the completion of his engagement there he was secured by Smith & Lovett for the steam system at their large iron works on Albany Street, where he has been the past fourteen years. The plant here consists of a twenty-four horse power Corliss Engine, a forty-five horse power boiler and a large heating apparatus. During the time he has been connected here he has made continual improvements in the system, and in point of efficient management and general results obtained, it is second to none in the city. He does his own repairing and fitting, and his work is exceedingly thorough. He is a member of the Society of Forresters, and is well known among the prominent engineers of Boston.

H. G. HEALEY was born in the Provinces in 1850, where he attended school until fourteen years of age, when he was thrown on his own resources and obliged to strike out in life for himself. He came to the States when quite young, and served his time at steam-fitting in Lynn, remaining about two years, after which he secured the position of fireman in one of the large factories of that place. At the end of three years he went to Fitchburg and entered the works of the Putnam Machine Company, where he served four years, after which he secured an engine, running it nearly two

years. On completing his labors there he entered the service of the merchant marine, as oiler on the steamship *Glaucus* of the Metropolitan line, plying between New York and Boston, where he was soon promoted to first assistant engineer, which position he occupied about two years. Later he was connected with various steam enterprises, setting up engines and boilers for some time, after which he came to Boston to assume full charge of the plant at the Massachusetts State Prison, where he remained four years, resigning in favor of Robert Bishop's Cotton Mills in South Boston, where he was engineer in chief for some time, at the close of which he came to A. Ceppi & Co.'s large moulding works on Albany Street, where he has been the past four years, during which he has travelled somewhat in the West in the interests of his plant. He is connected with the Society of the Pilgrim Fathers, and is a member of the Lynn Mutual Benefit Association. The plant of which Mr. Healey has charge, consists of one Kendall & Roberts forty horse power engine, and one fifty horse power horizontal boiler. He is a most efficient engineer and prominently known in the city.

A. W. BROWN was born in Woburn, in 1856. When about three years old his people moved to Lynn, and it was there that he attended school. When sixteen years of age he began work for himself, and for a few years was interested in various enterprises, finally going to Salem, where he served his time. On finishing his work there he returned to Lynn and secured an engine, which he continued to run some time for Jerome Ingalls.

Later he was connected with the well-known Pevere & Co., and some time after that with Charles Knapp & Co.,

where he remained until he became interested in steam fitting, in which line he continued four years, or until assuming his present position as engineer in chief at the novelty wood works of J. J. McNutt & Co., on Harrison Avenue, where next October he will have been seven years. The plant consists of two Whittier engines, one sixty and one one hundred and twenty-five horse power boiler, and one Worthington and one Knowles pump. Mr. Brown is a most able engineer, and in his management is very efficient, continually improving his plant, as is evidenced by its high standard of excellence.

MR. B. FRANKLIN SANBORN was born in Charlestown, Dec. 13, 1836, where he attended the public schools graduating with honor at the Charlestown High School. On completing his education, he entered the drug store of a well-known apothecary where he served three years. This, however, was not at all to his mind, for being of an active temperament, the confinement with little occupation proved irksome, and he soon bid farewell to the pestle and mortar, entering the machine shop of Allen & Endicott. He was connected there some years, after which he went to the Walworth Manufacturing Company, and later to the Atlantic Works. In 1861 he entered the service of the Union in the Fifth Massachusetts Regiment, Co. D, serving three months or until December, when he entered the navy. He was soon appointed engineer, and assigned to one of the boats under Admiral Farragut, where he served in the squadron on the Mississippi at New Orleans and adjacent localities until 1865. At the close of the war he entered the merchant marine, going to Japan and South America, returning two years later to enter the Atlantic Works, from which he came

to the Boston & Albany grain elevator to place in position their steam plant, and for over eighteen years he has most ably conducted the system. In politics he is a Republican, having twice been a candidate for the city council from his ward in Brighton, which is a most pronounced Democratic district, being the last time defeated by only fifteen votes. He is a Mason, a Knight of Honor, a member of the Veteran Firemen of Charlestown, and the past two years has been Commander of Post 92 of the Grand Army of the Republic.

The plant of which he has charge consists of three forty horse power boilers, and a pair of seventy-five horse power engines. This immense elevator has a storage capacity for five hundred thousand bushels of grain, and is capable of elevating fifty thousand bushels per day.

MR. PHILIP YAKLE was born in Baden, Germany, in 1838. When twelve years of age he began work on the farm, and for four years continued to discharge his daily duties with conscientious labor. Being in the springtime of life and having an ambition for a more extended field, he turned his face toward America.

On his arrival, a stranger in a strange land, without work or friends, his determination to succeed was strengthened by the opportunities which he conceived he could make conducive to his advantage. Naturally of a mechanical inclination, he sought the works of the Whittier Machine Company, where for the long period of thirty-one years he has remained, displaying oneness of purpose, fixedness of effort and strength of will, rising from apprentice to engineer. The plant of which he has charge consists of one twenty-five horse power engine, one forty horse power boiler and a large

steam fire pump. Mr. Yackle's record of thirty-one years at one place is probably the longest of any engineer in the city.

MR. CHARLES J. BOUGE was born Sept. 15th, 1857, in Manchester, N. H. When quite young his people removed to Lowell, and it was there that the rudiments of his education were acquired, graduating at the Green Grammar School. On coming to Boston he was inclined to enter one of our large machine shops, but concluded to go to New York. He finally made arrangements to serve his time in Providence, and his unceasing efforts to perfect himself in his chosen work have resulted in merited success. Naturally of an ambitious disposition, he was ever looking forward to greater things, and was soon connected with the establishment of Brown & Sharp, where he remained two years, after which he went to the Providence Tool Company where for over four years his conscientious labors were highly appreciated.

The next few years of his life were occupied in various steam interests in New York and New Jersey, after which he entered the service of the Electric Light Company, acquiring his experience with Blevaney, of Newark, with whom he was connected nearly a year.

On completing his time there he went to Brooklyn, N. Y., with the Broadway Manufacturing Company, after which for sixteen months, he was interested in the Excelsior Electric Light Company under William Hockhousen. He next came to Boston with the American Electric Illuminating Company, and gradually worked into his present position of engineer in chief at the merchant's station on Congress Street, where in the past two years he has amply demonstrated his

ability. He is an Odd Fellow, being a member of Marion Lodge, No. 26, of Newark, N. J. The plant at this station consists of eleven fifty horse power engines, with boilers having a capacity of seven hundred and fifty horse power and a Sturtevant six foot blower for ventilation. The electric apparatus consists of twenty Thomson-Houston machines, having a capacity of five hundred and fifty arch lights, and an American machine with a fifty light capacity. They also furnish power for the Daft generators of fifty horse power for motive purposes.

ROBERT MORRISON, ESQ., was born Jan. 24th, 1843, on Atkinson Street, now Congress Street, Boston. He attended the public schools of the city, where he proved an apt and diligent pupil until he went to work for himself. He served his time in Colt's Armory, of Hartford, Conn., where he was at the breaking out of the Rebellion. Like a true son he entered the service of his country, and enlisted in the First Connecticut Artillery, doing noble work until the close of the war. He first went to Worcester where he commenced his service at steam fitting there, with the well-known T. S. Clorgston & Co., where he was connected some years, after which he was with the old firm of W. H. Low & Co., at the Province Court Iron Works, where for sixteen years he had among other work the charge of the general work at the Parker House. About two years ago, when the management were about to enlarge and improve this magnificent building, arrangements were made whereby he was enabled to devote his whole time to their interests. In politics he is a Democrat, being prominently connected with Ward 14, of South Boston, having served on the Ward and City Committee, and is a member of Post No. 40 of the Grand Army

of the Republic, having belonged to this order since its organization. The plant at the Parker House consists of three twenty-five horse power engines, four fifty-four inch boilers, a Blake and a Davidson pump and a complete fire extinguishing apparatus. Mr. Morrison is most efficient in his chosen profession.

MR. C. C. LANE was born in 1830, in Oswego, N. Y., where he lived until he was fifteen years old. Going to work at the early age of ten, his education was necessarily acquired evenings and at odd moments, but he was very successful in his work, having at fourteen served his time and at sixteen received a man's full pay.

This naturally gave him great courage in the start of life, and at eighteen, full of ambition and hope for the future, he went to Brooklyn, entering the works of William Burden & Co., extensive machine builders, where he was connected some time. When he had completed his work there, he returned to Oswego, first to his old position in the shop, later being interested in blacksmithing at the same place, after which he went to Niagara Falls, where he was prominently connected with the construction of the suspension bridge. When this undertaking was completed, he was secured by the railroad for their works at Akron, Ohio, where he had full charge of the general construction department, after which he went to Montana, and later to Zanesville, where he remained some time.

From there he went to Little Washington. The outlook, however, was not propitious, and he soon returned to the Falls, in company with two friends, and leaving them at this place he continued on to Rochester, entering the locomotive works, and in a short time was running from

Rochester to Buffalo on the railroad. Later he was located in Lockport, Syracuse, Port Bond, and West Troy, in fact, moving from place to place, for six months looking about for something to his liking, when he came to Boston, at once entering the fancy iron works of Chase Bros. After that he was interested in general iron work for a few years, until he became connected with the Eastern Railroad, being the first one to do general work on the Saugus Branch, where he had full charge of the men. When this work was finished, Chief Engineer Reed persuaded him to go with him to Waterbury, Conn., where he remained but a short time. When he came back to Boston, he assumed full charge of the Edge Tool Works of Capt. Joseph Jacobs in Hingham, where he remained over seven years, at the end of which time he carried his engine in a schooner to Bathurst Point, where he placed it in position, running up the stars and stripes for the first time to the astonished gaze of the natives. When this plant was well under way he returned to his old position at Chase Bros. At this time the war broke out and he entered the service in Co. D, the 44th Regiment of Massachusetts Volunteers, late being in the Third New York Cavalry, serving under Commander Perry. On returning to his home in Waltham, he superintended the construction of the world-renowned Eureka Clothes Wringer, after which he removed to Dorchester and was interested in the Steam Saw Mills of Hiram Curtis. At this time the selectmen of the town induced him to assume charge of the new steam fire engine No. 2, which had just been secured; this position he occupied until the annexation of the town to Boston, when it was renumbered to seventeen. Soon after this he made a trip to California, locating in San Francisco, where he was connected over three years in the steam fitting of the

Palace Hotel and other large buildings in the State.

On his return East the building owned by H. & F. Lee was in process of erection, and he was induced to assume charge of the steam plant, where for the past thirteen years he has most efficiently conducted the service. The system consists of three Whittier one hundred and fifty horse power boilers and one forty horse power Brown Engine. He also has charge of the plants in several adjacent buildings that form a part of the Lee estate, among which may be mentioned 115 and 117 Summer Street and 26 and 28 Lincoln Street. Mr. Lane is a member of Post No. 68 of the Grand Army of the Republic, is prominently connected with the Veteran Firemen, and stands in the foremost rank among the engineers of the city. His son, who has been with him for over eight years, is his first assistant.

MR. M. J. GLEASON was born in 1848, in Boston, where he attended the public schools until he was twelve years old, when he entered the Boston Locomotive Works, remaining for the long period of fourteen years. Being a thorough mechanic of more than ordinary skill, his services were soon in demand for special work by Henry Southers, the well-known brewer, where he continued in full charge twelve years, making many valuable improvements, finally resigning to fit up the estate of Eben B. Philips on Atlantic Avenue. He was there some three years placing the plant in complete order and perfecting all the appointments of the system, when at that time the building of the Lithographic Works of J. H. Bufford's Sons at Harrison Square was nearing completion, and his services were secured for the same work there.

After three years, becoming interested in various steam undertakings, he resigned his position and devoted his whole time to this outside work until three years ago when he became connected with the Brush Electric Light Company, where he remained until about one year ago when he came to his present position at the Commonwealth Hotel. Mr. Gleason is a practical mechanic and in his knowledge of steam and other kindred subjects is most thorough.

MR. C. W. SMITH was born in East Greenwich, R. I., in 1848, where he received his early education. When the time to look for an occupation came, being of a bright and active disposition, he decided to interest himself in steam. He accordingly became connected with a repair shop in Providence, serving two years, after which he went to Southern Rhode Island in connection with a large steam plant in that section. On the completion of his work there he came to Boston, being offered the position of first assistant engineer at the well-known Flagg mill, where he remained two years, resigning to assume full charge of an engine in Weymouth. He was connected there over five years, at the end of which period he came to the J. M. Beebe estate where he has been the past six years. He has made many improvements in his plant, having a clear conception and thorough knowledge of steam, and to him is largely due the standard of excellence this system has attained. It is efficiently managed and the results are most satisfactory.

In politics he is a Prohibitionist, always being at the front in the cause of temperance. He is a member of the Delta Lodge of Free and Accepted Masons of Weymouth, and is prominently connected with Lodge No. 53 of the

American Legion of Honor, and the Independent Order of Steam Engineers, No. 1, of Boston.

This plant consists of one forty-horse power engine, one sixty horse power boiler, one Sturtevant Blower and a steam heating apparatus. Mr. Smith is located at the Windsor Block on Dover Street, and his name will always be among the leading engineers of Boston.

MR. C. F. MACK was born in 1828, in Portland, Me., where the district school afforded him his education. He went to work at a very early age, following the sea in a coasting way for a number of years. The Old Portland Packet was then in its palmy days, and it was on this vessel that he made his first voyage, being only eleven years old. After several years of this life he learned the trade of a rigger, working at it about a year, but this proving unsatisfactory, he turned his attention to cabinet work in which he remained until 1847, when he went as fireman on the Atlantic and St. Lawrence, now the Grand Trunk Railroad; after four years he was appointed to a position on the Portland police force, where he did good work for over a year, after which he returned to the railroad, going on the Kennebeck & Portland, now the Maine Central, where he remained five years. At the end of this period he again went to the Grand Trunk Line to assume charge of the round house, but after a few years went to the Great Northwestern Railroad and later to the Pennsylvania Central, returning again to the Northwestern. He next was connected with the Rock Island route, and then with the Burlington, having full charge for some years of the round house at Burlington. On completing his engagement there he came to Boston to occupy his present position as engineer with

the Emerson Piano Co., where he has been the past three years. He is a Democrat, and takes a lively interest in politics in general. The plant of which he has charge consists of one ninety horse power engine, and two sixty horse power boilers. Mr. Mack has made many improvements in his service and has had a large and varied experience with almost every kind of an engine manufactured in the United States

MR. M. J. PORTELL was born in 1849, in Platsburg, N. Y., but moving to Vermont when a boy, his education was largely acquired in that State in the public schools of Montpelier. He was early thrown on his own resources, and having a mechanical disposition, entered the employ of the Vermont Central Railroad in the steam fitting department where he remained three years, after which he entered the service of the Boston & Maine in the same capacity, having charge of the outside work for over eleven years. On finishing his term there, he came to Boston to assume entire charge of the plant at the Reed's Block, where he has been nearly four years, continually improving his system and elevating it to a higher standard of excellence. He has recently completed a very valuable contrivance for drying Japan work. It consists of a steam oven constructed on scientific principles, containing coils of steam pipe and various appliances connected in a new and most approved method, which for its simplicity of construction and efficiency in work is most interesting. It is the only one in the city and his own idea, being entirely different from anything heretofore invented for the purpose. The plant here consists of one two hundred and fifty horse power Brown Engine, and four eighty horse power boilers, a Knowles pump and a Han-

cock inspirator. Mr. Portell is located at Albany Street, and his name will ever be prominent among the engineers of Boston.



JAMES H. RUSH, ESQ., was born in 1847, in East Boston, educated at Hawes School, South Boston. At an early age he entered the machine shop of Aquilla Adams, and at these well-known marine engine works served his apprenticeship. During the war when the Confederate Gen. Early made his celebrated raid around Washington, Mr. Rush, then a mere lad, shouldered his musket in company with the rest of the apprentice boys, and went forth in obedience to a call from President Lincoln for troops to defend the National Capital. He served in Co. F, 6th Mass., under command of Capt.

Henry W. Wilson. Shortly after he went to Hayti, on a gunboat called the Maratanza, in the U. S. service. On her arrival there Mr. Rush and another engineer signed articles under the Haytien flag, and the gunboat was afterwards known as the "Salnave." He was employed under the personal direction of President Salnave, making shell, his labors being finally brought to a close by the downfall of the government. During that time he was in many severe engagements, principally Aux Cayes, Jacmel, Jeremie and Gonaives, where his shell were used, being the first and only ones that were manufactured on the island.

At the downfall of the Salnave government, he returned to Boston, soon, however, going to Cuba, where he was engineer in chief on the Zaza Plantation, owned by Excmo Sor D. Julian de Zulueta, where he remained until the Hemenway Building, No. 10 Tremont Street, was about to be constructed. He came home in season to attend the erection of this steam plant, and since that time has achieved marked success in conducting the steam system of which he has control. It consists of two forty-five horse power Ingalls & Kendrick sectional boilers, one freight and two passenger Whittier Elevators. He is one of the most prominent engineers of the city.

MR. JOHN BLAKE was born in 1839, in Fairfield, Me., where he attended the district school, and later the academy, graduating with honor at an early age. The sea seemed to have for him a peculiar fascination, and he soon shipped on a sailing vessel, where he at once became the favorite of the whole crew. For over twelve years he followed this vocation, during which time he visited all of the principal ports of the world, rising from cabin boy to first mate. At the end of

this period he gave up the sailing craft and became connected with a steamboat as fireman; but naturally of a mechanical turn of mind, he soon became interested in the workings of the engine and in a short time had become familiar with its general construction, and therefore was frequently called upon to assist the engineer in his work, and ere long was given full charge of one on another boat. He was in the merchant marine service some ten years, during which time he was clerk of one of the New York lines and agent for the Kennebeck & Portland Steamship Company. On completing his engagement there, he came to Boston to assume charge of the steam plant of Heyer Brothers, remaining two years, or until the Boston fire. After that he went to the New England Conservatory of Music at Music Hall for about the same length of time. He next was with the Western Union Telegraph Company nearly three years, resigning to go to the Boston Post Office as fireman, where he remained six years. About four years ago he was secured by the Williams estate, located at 19 Chauncy Street, to take full charge of their steam interests, where he is continually improving his plant, which consists of two thirty horse power engines and boilers of about the same capacity. He has had a wide experience in the service of steam, and is very efficient in its management.

MR. MICHAEL KEIF was born in County Clare Ireland in 1845. He served his time in the world-renowned London Steel Works, where he remained ten years. He manifested more than ordinary interest in his work, and his services were considered of great value, as the result of his labor was always satisfactory in the accuracy of its intricate conception. When about twenty-five years of age, he determined to try

his fortunes in this country, and on his arrival entered at once the works of Oscar Foot & Co., of Roxbury, where he remained nine years, resigning to accept the position of engineer at the Boston Cordage Company, where he was connected until about ten years ago, when he came to the works of the Standard Cordage Company, in the same capacity. Mr. Keif is a member of the Mutual Relief Association, and his plant consists of two sixty horse power Kendall and Robells boilers, and one pair of seventy-five horse power engines. He is a most conscientious and efficient engineer.

MR. JOSEPH KELLUP was born in 1832, in Windsor, N. S. Being naturally of a progressive mind, he went to work at an early age, going to sea when only nineteen. He has visited nearly every important port in the world, and from an experience of fifteen years on all kinds of sailing craft, can relate many interesting narratives of the various parts of the world, and its many peoples. On giving up the sea, having a mechanical inclination, he naturally interested himself in steam, and that he might have a larger field, came to Boston, entering the well-known works of Hinckley & Co., where he remained three years. On completing his work there he was secured by Chickering & Sons for their large plant on Tremont Street, where he has been connected over twenty-three years, rising from fireman to engineer. His judicious management of this plant, which consists of six fifty horse power boilers, and a two hundred and twenty-five horse power engine, places him in the foremost rank of the engineers of the city, and to his unfaltering perseverance and unceasing energy is largely due the high degree of excellence which this system has attained.

MR. M. H. DAILEY was born in 1834, in Newton, where he attended the public school until he began work for himself. Having a natural inclination toward mechanical things and being of an ambitious disposition, he entered the establishment of Otis Petlee & Co., where he served his time. Desiring to associate himself with some large enterprise, he made arrangements that enabled him to connect himself with the well-known N. C. Monson, and was there ten years at one time and another; he was interested with him in his many undertakings, proving of great assistance, and demonstrating his ability for the work which he was called upon to perform. At one time he was connected with Durgin & Co., of Somerville, and later occupied the position of engineer for two years on the Eastern Railroad, after which he went to the establishment of Parker & Sylvester where he remained some time, resigning to accept the position of assistant engineer at the Merchants Electric Lighting Station on Congress Street, where for nearly two years he has ably been connected.

Having been in the service of steam over thirty years, he is one of the practical and progressive engineers of the city.

MR. G. W. BEARD was born in Charlestown, in 1828, and was an attendant at the public school until sixteen years of age, when he first engaged in steam work. After serving his time he went into the navy, where he remained about two years, after which going into the service of the merchant marine, he continued fourteen years, visiting many important places along the coast, among which may be mentioned New Orleans and Havana. Later he was connected with the line between Provincetown and Boston for a period of four years, and for three years between the Isles of Shoals and

Portsmouth. He then accepted the position of engineer at the lumber-dressing mill of Watson & Bisbee in this city, where he remained for the long period of ten years, when he was secured by the Western Union Telegraph Company at 109 State Street, and for eight years efficiently conducted their system, when he retired from active service.

His home has been at the Merrimac House for the past twenty years, and his successful career has afforded him much real enjoyment, as he has been instrumental in making many improvements in various steam plants, enhancing their value and increasing their capacity. During the Rebellion he was on picket duty at Fort Sumpter, Charleston Harbor. He has been in the steam service forty-one years, and holds a certificate as engineer of the highest grade for ocean steamships. Mr. Beard's accomplishments in the steam service place his name in a conspicuous position among the leading engineers of the city.

MR. C. H. SENTER was born in 1833 in Plymouth, where he attended the district school until he was eight years of age, when he came to Boston.

Though a mere child, he had been in the city but about two weeks when he entered the woodenware store of Kendall P. Saunders as errand-boy, where he worked during the summer earning the money to defray his expenses while attending school in the winter. Having an indomitable will and unlimited perseverance, he succeeded in acquiring an education, on the completion of which he entered the glass works of Edward P. Kelley.

That, however, did not seem to be to his liking, and in a short time he left the establishment to enter the printing-house of Coolidge & Wylie, where he served three years.

Meanwhile he had become acquainted with an engineer, and after frequent visits to his plant decided to get what points he could from him. The result was that he secured the position as fireman with him at the planing-mill of George Curtis on Tyler Street, and later followed him to J. F. Keating's, where, on the departure of his friend, though only fifteen years of age, he assumed full charge of the engine. Some time after that the mill was destroyed by fire, and he at once tried to obtain a position elsewhere as engineer, but on account of his youth was unsuccessful. Knowing that time would overcome this difficulty, he complacently entered the morocco works in Charlestown to await the development of this undertaking, later going to the works in Lynn in the same capacity, but, to his joy, an engine was soon introduced and given him, and a short time fully demonstrated his ability to hold the position. After that he was connected with Souther & Blaney, and later with Keene Bros., where he remained eight years, resigning to take charge of the city steam-works, where he continued until the plant was sold. Four years ago he came to the Philips estate on Atlantic Avenue, where he has exhibited a most marked degree of efficiency in his management, continually introducing improvements and augmenting his service, which consists of one one hundred and twenty-five horse power Kendall & Roberts boiler and an eighty horse power Chubbuck engine. Mr. Senter was for three years in Nym's Battery, and is one of our most prominent engineers.

DAVID THOMAS, ESQ., was born in 1836, in Liverpool, England. Thrown on his own resources at an early age, he was obliged to gain a livelihood by untiring zeal and unceasing effort. The opportunities for advancement in

his native place being limited, his ever-active mind was not slow in forming and putting into operation a resolve to try his fortune across the sea. He accordingly obeyed the promptings of his ambition, and came to the States, going first to Alabama, where he was on the Tombigbee River among the steamboats until the breaking out of the war. At that time he came North and aided the Union in the suppression of the Rebellion by his service on the steamboats that were transporting troops to the South. At the close of the strife, having become attached to the sea, he entered the merchant marine as engineer, making a two years' trip to China. On his return he was offered a position in one of the large mills of Newton, where for eight years he efficiently conducted the steam plant, resigning at last in favor of his present position at the works of the Roxbury Carpet Company, where for nine years he has continued to make valuable improvements, during which time the system has nearly doubled in its capacity. He is a Mason, and is deeply interested in all of the important questions of the day. He has charge of eleven fifty horse power boilers, one two hundred and twenty-five horse power engine, eight pumps and three inspirators. Mr. Thomas' success amply demonstrates his ability, and his judicious management places him among the prominent engineers of the city.

MR. C. A. BUCKSEY was born in 1852, in the south of England, in the old town of Portsmouth, where he acquired his education. When but a boy his intellectual superiority was apparent, and, having a mechanical inclination, his walk in life was soon in the avenue of mechanical industry. For some time he was connected with many of the largest establish-

ments in the United Kingdom, from one of which he was sent to Halifax to superintend the construction of a large steam plant in the British Navy Yard, where he remained seven years. On the completion of the work, his natural ambition prompted him to visit the United States, and on his arrival in Boston was so much pleased with the place that he concluded to remain for a time, securing the position of engineer at the Meaney Marble Works on Albany Street, where he has so ably and unassumingly continued his labors to the present time. This plant consists of one seventy-five horse power engine and an eighty horse power boiler.

Mr. Bucksey is a Republican and a member of Burns' Lodge, No. 10, of Free and Accepted Masons of Halifax, and is one of the best engineers in Boston.

MR. H. B. ROBERTS was born in Pembroke, Me., on August 6th, 1851. When two years of age his parents removed to Dennisonville, where they resided eight years, after which they again moved to Calais, where he received his education. Being thrown on his own resources at the age of fourteen, he concluded to launch out on the untried sea of fortune, first serving his time with a well-known blacksmith, after which he entered a machine shop, where he remained about three years. Having an indomitable energy, and desiring to enter a larger field, where his inventive faculties might have full scope, he turned his steps toward Boston where he entered the Boston and Albany machine shop, and after remaining about one year went as fireman on the road, remaining seven years. At this time the position of engineer in chief at the large and magnificent State Street Block was offered him, which he has filled the past eleven years with unfaltering perseverance, proving

that the qualities exhibited in youth were worthy the cultivation and care bestowed upon the attainment of his success. The plant consists of two seventy-five horse power engines and two eighty-five horse power boilers which furnish power for some seventeen elevators. In point of management and mechanical skill, Mr. Roberts has exhibited his discretion and ability by the many improvements he has inaugurated and the perfectness of arrangements connected with his plant.

MR. D. S. MCGREGGOR was born in Lubeck, Me., in 1850, although his boyhood days were mostly spent in the city of Portland where his people removed when he was but a child. His opportunities for an education were somewhat encroached upon, as he entered a machine shop at the early age of thirteen, but this was but a trifling circumstance for one of his capacity, as the evenings and odd moments, which he afterward devoted to this end, were hours of pleasure and enjoyment. When he had served his time he entered the works of the Portland Shovel Company, where he remained two years, after which he was connected with the world-renowned Grover and Baker Sewing Machine Company, where his consistent bearing and general affability gained for him the esteem of all with whom he came in contact. At the close of four years, fortune directed his steps to this city, where on his arrival he was offered a position in the works of the East Boston Screw Company, where he rendered most valuable service for over three years. Being a thorough mechanic, and devoting his time and concentrating his efforts to the better understanding of his work, he amply demonstrated his ability for the position which he was soon called upon to fill as engineer in chief at

the extensive organ works of E. & G. G. Hook & Hastings, where his fifteen years of untiring energy has been rewarded by the elevated position which his plant has attained. He has in many ways improved his system, among other things having recently perfected an invention for opening and closing the doors and dampers of the boilers, which for its simplicity and convenience could hardly be improved. He is a Republican Prohibitionist in politics, is a member of the Temple of Honor, and is prominently connected with the Trinity Baptist Church of East Boston, having a class of forty adults in the Sunday School. His plant consists of two thirty horse power Whittier boilers, and a twenty-five horse power upright engine.

MR. E. W. SKINNER was born in 1852, in Lynn, where he attended the public schools until he was fourteen years of age, at which time, much to his disappointment, he was obliged to abandon his studies and address his attention to the more serious work of obtaining a livelihood. He had nothing, however, in his nature of timidity or hesitancy, but struck out boldly and with a determination to succeed in whatever he should undertake. After due consideration, he decided to follow his inclination and serve his time at the machinist's trade, entering the works of the Water Power Machine Company, of Biddeford, Me., where he was connected some time, after which he went to the well-known works of T. D. Tripp & Co., of Lynn, where for three years he devoted his best energies. When he had finished his work there he was offered a position in Lawrence, which he accepted, remaining four years, resigning in favor of a large manufacturing concern in Worcester.

He had been connected there but about one year when he received a very flattering offer from R. H. White & Co., of this city, and for ten years he has uninterruptedly conducted his improvements. The plant consists of five engines of about two hundred and fifty horse power, and five sixty horse power boilers. Mr. Skinner is an Odd Fellow, a member of Joseph Webb Lodge of Free and Accepted Masons, and is very prominent among the engineers of the city.

MR. ROBERT NELSON was born in 1831, in Scotland, coming to this country when a mere child, located in Newburyport, where he attended the public school. Like a true son of Scotia he was interested in all about him, and devoted his whole time and attention to whatever he undertook. As a boy he was cheerful and active, and having a passionate liking for work of a mechanical nature, served his time in a machine shop in Medway Village, where he remained some time, happy in the bestowal of his time and energies on his beloved work. On the completion of his service there he went to Wrentham, remaining but a short time, that he might accept the position as engineer at the Union Straw Works at Foxboro, where, for the long period of twenty years he continued his judicious and successful management of the plant. At the end of that period he was secured by B. D. Whitcomb & Co., where on the fifteenth day of May he had been fifteen years. The plant here consists of one eighty horse power engine and two sixty horse power boilers. Mr. Nelson is an Odd Fellow, and is one of the oldest and most successful engineers of Boston.

MR. E. F. BETTER was born in Revere, in 1857, where he received, until fourteen years of age, what advantages the common schools at that time afforded, when he began work for himself. At that time the principal industry of the place was agriculture, and he accordingly began his career on the farm. This, however, was not to his mind, and being of a mechanical inclination he determined to interest himself in that line when opportunity should present itself.

He had not long to wait, for through the influence of a friend he obtained a situation in a large machine shop, where he served three years. On completing his work there he went to Waltham, where he was connected some time, from which place he went to 383 Washington Street, with Ripley, Howland & Co. Later he secured the position of fireman at 65 Summer Street, where he remained four years, devoting his spare moments to the study of engineering and acquiring a knowledge of the general workings of steam. Being of a quick and assimilative nature, he was, at the end of that period, enabled to put the theories which he had evolved, into practice on a twelve horse power engine at the Moses Williams' estate, where he amply demonstrated his ability to assume charge of the plant at No. 3 Appleton Street, where he now furnishes the power and heat for A. J. Faxon & Co., manufacturers of piano hardware, and for the C. C. Briggs' Piano Co. Mr. Better has charge of two sixty horse power boilers and a forty horse power engine. He is progressive and is always interested in all improvements connected with his work, and is well known among the engineers of the city.

MR. E. J. WEST was born in 1843 in Oneida, N. Y., where he attended the public schools until going to work

for himself. He first learned the trade of a mason, which he followed with varying success until the breaking out of the Rebellion, when he enlisted in the service of the One Hundred and Fifty-Seventh New York Regiment, later being with the Oneida Cavalry. He was in many of the most important engagements, and did gallant work for the Union. At the close of the war he went West, first to Colorado, where he was interested in some of the prominent gold mines, and later was connected with various enterprises for about three years. At the end of that period he went on the Union Pacific Railroad, where he was connected with the construction department about four years or until 1871, when he came East. He has at various times been on the Delaware, Lackawanna and Western, New York Central, and the New York and New England Railroads, and his experience as a railroad man has been very extensive.

About a year ago he came to Boston and assumed full charge of the plant of Shepard, Norwell & Co., on Winter Street, where he has inaugurated many valuable improvements. He is a Mason, a member of the Grand Army of the Republic, and is prominently connected with the Brotherhood of Locomotive Engineers. This plant consists of a fifty horse power Brown engine, two fifty horse power boilers, pumps and inspirators. Mr. West is a most successful engineer.

WILLIAM POOLE, ESQ., was born in Edgecomb, Me., in 1834, where he attended the district school, manifesting an apt and intelligent disposition. The first years of his boyhood were spent much like those of his companions, as he manifested no especial mechanical inclination until about

twenty years of age. Opportunity at this time, however, did not present itself to enable him to follow his impulses, so for a few years he employed his time on the farm. At the end of that period he came to Boston with the determination to secure a position in some capacity in a machine shop, and his efforts were crowned with success, as he made arrangements with the American Tool Company where he served his time of three years. While attending to his daily duties he became interested in steam, and employed a large amount of his time in the perusal of works of that nature, at the same time acquiring what practical knowledge he could in the same direction. The result was that on the completion of his time he obtained a situation as engineer in Chickering Place, where for six years he ably conducted his plant. He next went to Harvard Place in the same capacity, where in a short time he had improved and augmented the service to such an extent that a great reduction in the coal consumption and a larger amount of work was secured. He remained there thirteen years, fully demonstrating his ability to assume the position which he now occupies as engineer in chief at Congress Street Place, where for nearly fourteen years he has continued his improvements. The plant here consists of one fifty horse power Brown engine and a hundred and twenty-five horse power Whittier boiler.

MR. J. M. COTTAM was born in 1860, in East Boston, where he attended the public school. As a boy he manifested a strong desire for mechanical things, continually constructing some contrivance of an intricate nature, and one might almost imagine that his birthplace and surroundings would somewhat inspire him to enter upon a life work

in the line in which his native place is so largely interested. At all events, when fifteen years of age, he came to town and secured the position of fireman at the large lumber dressing mill of Palmer & Parker, where he has been eight years, having remained through the change of the plant from the above-mentioned firm to the Hawkins Machine Company, where now as engineer he has full charge of the steam system.

Though a young man, and in the service a comparatively short time, his knowledge of the work is most thorough and his success has been marked indeed, amply demonstrating his ability and reflecting great credit on his father, who has for many years been known among the engineers of the city. The plant consists of one twenty-five horse power engine and two forty horse power boilers. Mr. Cottam is an independent Republican and is a member of the National Society of Steam Engineers.

C. R. HOOPER, ESQ., was born in 1855, at Milton Mills, N. H. He acquired his education in the public school of his native place where he remained until fifteen years of age, at which time he went to work for himself. He served his time in a large boiler establishment, and meeting with more than ordinary success, remained some three years over his serving time. While there he had become familiar with engines of various kinds, and being naturally quick and perceptive, was soon called upon to assist the engineer, and in a short time was detailed for special work in this capacity. He has been connected at different times with many of the largest and best known works of the State, among which may be mentioned the New Market Machine Company. Sometime later he went to the machine shop of the Boston

and Maine Railroad at Dover, where he remained three years, resigning in favor of his present position with the Derby Desk Manufacturing Company, at 55 Charlestown Street, where, for five years, he has most efficiently conducted the plant. To his constant and persistent efforts is largely due its present standard of excellence. Mr. Hooper has charge of one twenty-five horse power engine and a forty horse power boiler, and his name is among those of the prominent engineers of the city.

MR. OWEN A. WILLIAMS was born in 1843, in Wales, where he was brought up on a farm, remaining some seven years in this work, after which he became connected with an extensive flour mill and coal yard where he held the position of superintendent over ten years. His faithfulness there in attending to the business of his employer, and the persistent efforts which he made to further the best interests of the works, gained for him many friends who assisted him to an interest in one of the slate quarries of that section. While there he first became interested in steam, and by constant application, soon mastered the general workings of an engine. At that time circumstances turned his thoughts toward America, and a few months more found him on this side of the Atlantic, looking about for employment. Though unacquainted with the customs of the land, the same energy which had conduced to his success at home, and the will that had prompted his ambition to seek his fortunes here, gave him strength and courage for the work before him, and ere long he was happily connected with the slate quarries of New York, where he remained some time. From there he went to Slédington, Penn., where a new engine was being placed in one of the quarries, and he made

every effort in his power to obtain the position of engineer, which was repeatedly promised him by the management, but without avail. This proved a disappointment of considerable magnitude, and he soon came East, relying on the promises of a friend for work, but on his arrival in Boston found his friend not so prompt, and being in need of employment of some character, entered the Boston and Albany freight house, where for about two months he was given night work, at the end of which he obtained a position at the works of the Boston Steam Company, after which he entered a foundry for a short time. This work, however, was not congenial, and once more he tried for a permanent position ; this time his efforts were crowned with success at the well-known pump works of Geo. F. Blake & Co., where, after being frequently called upon to assist in setting up and to supply in the absence of the engineer, he was promoted to the position which for the past eleven years he has so ably filled. The plant of which he has full charge consists of a seventy-five horse power engine and two sixty-five horse power locomotive boilers. Mr. Williams is a member of Mount Vernon Church, and is prominently connected with the Sunday School. He is one of the most conscientious and efficient of our engineers.

MR. SAMUEL MASON was born in 1855, in Cambridgeport, where he received his education. Going to work at the early age of twelve, his studies would have been somewhat crippled, had he not devoted his spare moments to his books. Naturally of a studious disposition, these moments were hours of enjoyment as well as profit. He first became connected with the boats in Boston harbor, occupying the humble position of deck hand, but one of his calibre could

not long remain in this capacity, and soon he was firing in the boiler room. As he advanced in years he continued to climb the ladder of fortune, leaving the fireman's round for that of the engineer, and rising still higher, donned the cap which bore the gilded letters "Captain." Among the boats in which he was interested may be mentioned the "Charles River," "Chapel," "J. C. Cottingham," and the "Mattie Sargent." After ten years he gave up steamboat life, and for six years occupied the position of engineer at the West Boston bridge, after which he was prominently connected with various steam interests. At the end of this period he was secured by A. H. Robinson & Co., for their plant, where he is efficiently conducting the work and continually studying to improve his system, which consists of one one hundred and fifty horse power engine and two eighty horse power boilers. Mr. Mason is a member of the Independent Society of Steam Engineers, and as an able and progressive engineer stands in the foremost rank.

JOHN B. WHITE, ESQ., was born in County Cork, Ireland, in 1847. When quite young he entered a hardware store, where he remained some time, coming to this country in 1870. His ambition prompted him to connect himself with some well-known house, and he accordingly entered the employ of O. Nichols & Co., as a cutter. Naturally of a quick, active mind, his advancement in his calling was such as to prominently bring him before the notice of his employers, and in a short time he was given the opportunity to acquire a thorough knowledge of steam, and in 1881 was promoted to the position of engineer, which for five years he has acceptably filled. Though but a few years in the service of steam, his persistent efforts to perfect himself in

his work and his untiring energy in the study of its scientific principles, can conduce to but one end, and that success. His plant consists of one thirty horse power boiler and a twenty horse power engine. In politics Mr. White is a Democrat, is a member of the Catholic Society of Foresters, having occupied the position of Chief Ranger of the Court of Sts. Peter and Paul, No. 15, and for ten years has been deputy of Sts. Peter and Paul's Total Abstinence Society.

MR. RICHARD TAYLOR was born in 1854, in England, where he was interested in various enterprises. He served his time in one of the large boiler works of the kingdom, and was connected with many of the large and well-known houses until 1870, when he came to this country in the furtherance of his own interests. He went first among the coal mines of Pennsylvania, but not finding employment to his mind, after two years came East, and entered a large rolling mill. On completing his engagement at that place, he made arrangements with J. F. Keany & Co., of 32 Lancaster Street, where he has full charge of one fifty horse power engine and a seventy-five horse power boiler. Mr. Taylor is conscientious in all his work, and is ever looking toward the improvement of his plant.

WALTER HENDERSON, ESQ., was born in 1850, in the old country, from whence he came when quite a young man to seek his fortune in America. Naturally ambitious, he soon made arrangements with J. L. Sheriff, of Dedham, which enabled him to serve his time in his well-known works. His success there was such, that for sixteen years he con-

tinued in full charge, and in that long period made many improvements in his plant. At the close of his labors there he entered the Dedham Fire Department, where as fireman he was connected two years ; after which he was offered the position of engineer at the brush manufactory of J. L. Whiting & Co., where for over eight years he has continued in full charge. He has one Putnam fifty horse power engine, two sixty horse power boilers, one Worthington pump and a large Knowles pump for drawing water from an artesian well having a depth of three hundred and forty feet, and forcing it above about ninety-five feet. Mr. Henderson has been very successful in his work, and has all the modern improvements throughout his plant, among which could be mentioned several of his own invention, which are very valuable. He is a well-known engineer in the city.

MR. C. H. STOCKEMER was born in 1853, in Bridgeport, Conn. Like other boys he attended the public school of his native place, later coming to Boston and completing his education by going to school when not at work. For several years he was interested in various things, coming in 1873 to the well-known establishment of C. F. Hovey & Co. Being naturally ambitious, he has, by close application to his labors, worked up to the position of chief engineer, and during his service of thirteen years, has introduced many improvements, continually increasing the efficiency of his plant, which consists of three elevator engines, one blower engine, a large fire pump, a small engine for running sewing machines and three sixty horse power boilers. Mr. Stockemer is a Democrat and an Odd Fellow, and is one of the prominent engineers of Boston.

MR. S. A. ALEXANDER was born in 1839, in Mt. Vernon, N. H., where he attended the school of the district in which he lived, until eighteen years of age, at which time he entered the Indian Head Mills at Nashua, as third hand, remaining three years. At the end of that period he followed the promptings of his ambition, and struck out for the West, going to Scranton, Penn., where for five years he was connected with the Delaware, Lackawanna and Western Railroad, first as fireman, and later as engineer. At that time the war broke out, and he enlisted in the One Hundred and Thirty-Second Pennsylvania Regiment, and for nine months was in active service. On his return he entered the Nashua Iron Works, where, for three years he remained as chief engineer, after which he again went West, going to Franklin, Penn., where he was interested in the oil country for two years. At the end of that time he returned East, coming to South Boston, where he entered the Bay State Iron Works, but after about two years went to the mills of J. F. Keating, on Portland Street, later being with the large establishment of Doe & Hunnewell, of East Cambridge, for five years. At that time he was secured by the management of Hotel Boylston, and for seven years continued in full charge of their plant. He has recently entered upon his new duties at the Masonic Temple, where he has full charge of two fifty horse power boilers and a small engine. Mr. Alexander is a Mason, an Odd Fellow, a member of the American Legion of Honor, and is prominently connected with the Royal Good Fellows. He is a most estimable gentleman and an honor to his position.

MR. P. J. PHILBEN was born in 1859, in County Mayo, Ireland, coming to this country when quite young. His

education was acquired in the public schools of this city, and at seventeen years of age, he began his career at the Waverly House, Charlestown, where for three years, he occupied the position of fireman. He next served a year in a machine shop, perfecting himself in the ins and outs of his work, securing at the end of the time, the same position at the old Adams House, where he was connected about four years, after which he served a year at steam fitting. When he had completed his time, desiring to see more of the world, he went to Chicago, where he was connected with the Gardner House and other well-known places, for some time. On his return East, he was offered a position with the Walker-Pratt Manufacturing Company, and for four years was a valued employé, being detailed by them to superintend the construction of the plant at the Young Men's Christian Association Building, on Boylston Street, where for three years, he has continued in successful charge of two sixty horse power boilers, automatic pumps, etc. He is very efficient in all his labors, and has a bright future before him.

MR. WILLIAM HANRAHAN was born in Limerick County, Ireland, but came to this country when about eighteen years of age. Being mechanically inclined, he addressed himself to the construction and running of heating furnaces, later, for five years, being connected at the Norway Steel and Iron Works, after which his services were secured for the plant in the Evans House, where for two years he has continued in full charge. It consists of one forty-eight and one fifteen horse power boiler and a large elevator engine. Mr. Hanrahan is a most thorough, reliable and conscientious engineer.

MR. F. J. DUNN was born in 1865, in Lewiston, Me., in the public schools of which place he manifested more than ordinary interest in his studies. Going to work at the early age of fourteen, he served his time at the machinist's trade, and for two years was continually studying the best authors on the service of steam. At the end of that period he was secured for the well-known Pavilion Hotel at Wolfboro', N. H., where he was connected several seasons. Two years ago he was engaged by the management of Hotel Hoffman, on Columbus Avenue, and has charge of two low pressure, and one high pressure engine. Though young in the service, Mr. Dunn has amply demonstrated his ability, and to-day his plant occupies a high position of excellence among the best known of the city.

MR. A. LOVELAND was born in the State of New York in 1850. As he expresses it, he is a self-made man; going to work at an early age, his education was necessarily somewhat curtailed, and though his success has been marked in his chosen work, it is due to his oneness of purpose and his fixedness of mind in whatever he undertook.

Naturally of an inventive mind and a mechanical inclination, he availed himself of the first opportunity which presented itself, to gain a thorough knowledge of steam. He served his time in one of the large engine and boiler works of New York, and on coming to Boston was first connected with the well-known house of L. M. Ham & Co., where he remained until he accepted his present position of engineer at the lumber dressing mill of Watson & Bisbee. He has charge of a fifty horse power engine and a sixty horse power boiler. Mr. Loveland is always alive to the

improvements in his line, and the changes he has made in his plant are most creditable, and his success has been marked. He is a thorough engineer.

MR. HUGH O'CONNOR was born in 1844, in Boston, where he was a constant attendant at the public school, until going to work for himself. When quite young he enlisted in the United States Navy in the steamship "Woned," and was on her when she blew up off Fort Carmel. He next served on the steamship "Lasocos" which was successful in capturing the ram "Alabama" in the Alabama sound. On returning home he obtained a situation as fireman where he remained some time, after which he was promoted to the position of first assistant engineer at the Mason and Hamlin Organ Works where he was connected three years. Later he was with some of the well-known houses of the city, among which may be mentioned H. D. Clark & Co., Boston Belting Company, the Cunningham Boiler Works, Bradley's Fertilizer Company, and the Exeter Packing Company. For the past eight years at various times he has been with the West Boston Planing Mills, where he has charge of one sixty horse power engine and a fifty horse power boiler. Mr. O'Connor is a member of Post No. 7 of the Grand Army of the Republic, and his success as an engineer is attributable to his perseverance and earnest labor in his chosen work.

JOHN JOYCE, ESQ., was born in County Kildare, Ireland, where as a boy he gave evidence of his mechanical inclination. He remained about home until twenty-two years of age, when, desiring a more extended field of action, he

joined a party of friends who were about to seek their fortunes in this country, and on his arrival entered the works of Isaac Adams, where he had been seventeen years when the firm was succeeded by the South Boston Iron Works. Through this change of management Mr. Joyce remained, and for the long period of twenty-three years has successfully carried on his work. Being thoroughly versed in all that pertains to his labors, and having a definite knowledge of the general workings of steam, his long service, covering a period of over thirty years, places him among the oldest and most experienced engineers of the city. He is an active, enterprising and progressive man, and has effected many valuable improvements in his plant, and his assiduous care in arriving at conclusions has conduced to the thorough equipment of his plant with all modern appliances.

MR. PHILIP BREMEN was born in 1843, in St. John, Newfoundland. When quite young the sea seemed to have for him a peculiar fascination, and it was with great difficulty he could be restrained from shipping until he should be old enough to do so. However, at fifteen years of age, unable longer to remain contented at home, he followed the promptings of his ambition, and for twelve years enjoyed the life of a jolly tar on the bounding billow, rising from a green hand to mate, and later to engineer. As he advanced in years he tired of this roving life, and so came to Boston, entering the works of the Boston Machine Company, where, for thirteen years he has been constantly improving and augmenting his plant, and in every way meeting the expectations of his employers. Being naturally of a mechanical turn of mind, he is ever acquiring valuable information in his line, and the success with which he has

met fully proves his ability. Mr. Bremen has charge of one sixty horse power engine and a seventy-five horse power boiler, and in point of efficient management this plant is second to none in the city.

MR. FREDERICK WHITTIER was born in 1859, in Readfield, Me., where he attended the public school, manifesting a bright and active disposition, and an aptness for things of a mechanical nature. Much of his time has been spent in steamboat service on the Kennebec River, having begun in the work when only fifteen years of age. From a general hand he was promoted to fireman, and again in a short time to engineer, where for five years he continued in successful service. On finishing his labors on the river, he was secured by a well-known contractor as chief engineer for general work, and for some years was connected with many of the largest manufacturing works of New England, among which may be named Cannon & Faxon, paper manufacturers of Lee, S. A. Fowle & Co.'s dye wood mill at Arlington, Arlington Mills at Lawrence, Bird's Paper Mill at Walpole, and the Somerville Flour Mills at Somerville. For the past three years he has had full charge of the plant at the South Boston Grain Elevator, and being thoroughly familiar with his work, has made many valuable improvements, reducing his coal consumption about thirty-three per cent., or over two hundred dollars per month. He is a Democrat and a member of the Brotherhood of Locomotive Engineers, having run on the Maine Central Railroad over two years. The plant here consists of a hundred horse power Corliss engine, and two seventy-five horse power boilers. Mr. Whittier is most efficient and successful in his work, and is one of the rising engineers of the city.

MR. CHARLES BROWN was born in 1841, in Limerick, Me., where he attended the public school until about seventeen years of age, when he came to Boston to look about for himself. For two or three years his work was in a room where there was an engine, and, becoming acquainted with the engineer, he improved the opportunity of acquiring what practical information he could in regard to the general workings of steam. Being from time to time called upon in the absence of the engineer, to assume charge temporarily, he gradually became familiar with the work, and accordingly was soon promoted to the position of engineer.

Some time after that he obtained a situation at the well-known works of Stickney & Poor, where for three years his labors were most successful. At the end of that period he was secured by Flint Bros., with whom he remained five years, after which for a short time he was connected with the Boston Water Works, from whence he came to the old and world-renowned house of W. K. Lewis & Bros., on Broad Street, where for sixteen years he has continued in uninterrupted prosperity, augmenting his plant and instituting improvements which place it among the first in the city. It consists of a seventy-five horse power Brown engine and a Kendell & Roberts seventy-five horse power boiler. The plant furnishes the power for fourteen elevators and two large coffee manufactories. Mr. Brown is an Odd Fellow, being a member of Oasis Lodge, of Winter Hill, Somerville, and is one of our best known and most successful engineers.

MR. C. F. DEARING was born in 1848, in Charlestown, where in the public schools he manifested a disposition

which foreshadowed his career in after life. Being so near the Government Navy Yard, he naturally, with other boys of his own age, spent many hours out of school among the cannon and pyramids of ball that are found so systematically arranged in the yard. In this he found much enjoyment, but nothing had so great a fascination for him as the huge boats that at all times were proudly riding at anchor but a short distance from the shore. One of these he determined should one day be his home, and accordingly when twelve years old he shipped in one of the monitors that had just been completed, and for one year was under constant fire in the harbor at Charleston, S. C. On his return he entered the machine shop at the navy yard where he served five years, after which he was prominently connected with the fire department of the city, first as hoseman of No. 4, and later as assistant engineman of No. 7, which position he occupied nearly twelve years. Desiring to see somewhat of his country, he went West, and for some years was connected with the A. T. & S. F. and the B. F. R. & G. Railroads, first as fireman and later as engineer. On his return East he was secured by C. U. Cotting for the Wakefield building, where he has had full charge about one year, having made many valuable improvements, and largely augmented the service of the plant, which consists of two forty horse power boilers, one forty horse power engine, a Blake pump, and a Hancock inspirator. Mr. Dearing is well-known among the engineers of the city, and is a thorough mechanic in every sense of the word.

MR. N. C. CHANDLER, so well known among the engineers of the city, was born in 1845, in Strafford, Vt., where he availed himself of the usual advantages offered by

the country district school, later going two terms to the village academy. Beginning work at the early age of twelve and coming to Boston when only seventeen, he entered the Atlantic Works, remaining until November, 1864, when he entered the quarter-master's department, going to Tennessee, remaining until the close of the war. On his return home he went to the Linseed Oil Works at East Boston, and for nine years efficiently conducted their plant. At the end of that period he went to the Concord States Prison, where, for fourteen months he had full charge of the steam system, which position he finally resigned in favor of his present one as chief engineer at the well-known creamery of C. Brigham & Co., on Tremont Street, where for three years he has continually improved his plant, which consists of a fifty horse power Brown engine, and two sixty horse power boilers, which furnish the power for seventeen elevators and a large number of churns, etc., etc. Mr. Chandler is among our most prominent engineers, and is one of the oldest in the service of steam in the city.

G. W. BARNARD, ESQ., was born in 1845, in Nantucket, where he graduated with honor at the Nantucket high school. When about eighteen years of age, he began work for himself and served his time at the old and well-known establishment of S. E. Chubbuck & Co., remaining three years. On the conclusion of his labors there, he entered the service of the Old Colony Railroad as fireman on one of the locomotives, where he remained about a year, at the end of which he was transferred to the Cape Cod repair shops, where for four years he was prominently connected. When he returned to Boston he went with the Whittier Machine Company and remained four years, or until he

entered the Boston Fire Department as assistant on Steamer No. 8. Mr. Barnard has been in this service twelve years, being promoted to engineman of No. 25. He is most efficient in his position and is well known in the department.

JOHN NUGENT, ESQ., was born in County Hesthmade, Ireland, in 1845, where he lived until about fifteen years of age, when, desiring a more extended field, he joined a company of friends who were about to seek their fortune in America, where in due time they landed in New York. Naturally of a mechanical turn of mind, he first sought a situation among the machine shops of the metropolis, where he remained two years, after which he came to Boston and interested himself nearly three years in brown stone cutting. On completing his labors there, he entered the boiler works of John Lally, in South Boston, and later connected himself with the Putnam Nail Works about the same length of time, after which, for some two years, he was with the Mason & Hamlin Organ Company. The next few years of his life were spent in the well-known works of George T. McLaughlin, and at the St. James Hotel, from whence he went to San Francisco, Cal., where he shipped as oiler on the Steamer "Cossipa," running between there and Portland, Oregon, and though on the boat but a few months, he acquired a thorough knowledge of marine engines. While in the West, he was connected among other well-known firms with the Miners' Machine Company, and the San Francisco Manufacturing Company, later going up to Marysville with a washing machine, which they fired with straw.

On his return to Boston he was secured by C. C. Lane as fireman for the Bedford Buildings, but afterward was

connected with the well-known John Hopkins and William Crane of the Baltimore Steamship Line. When he finished his labors there, he was secured by the Boston Dye and Chemical Works, after that, for about four years, being connected with the steam plant at the Boston University. On June 1st, 1882, the valuable services of Mr. Nugent were secured for the building occupied by Joy, Langdon & Co., and Perry, Cook & Tower, No. 89 Chauncy Street, where for the past four years he has continually studied to improve his system and place it on a higher plane of excellence. His plant consists of a fifteen foot boiler containing forty-nine three inch tubes and two sixteen horse power engines. Mr. Nugent is a most efficient engineer, and stands second to none in the city.

H. E. BUCHANAN, ESQ., was born in 1850, in Cape Breton Island, N. S., where, at the high school, he graduated with honor. Until eighteen years of age his time was given to study, but among other things he early evinced a love for mechanical work. He accordingly made arrangements that enabled him to serve his time in the engineer's department in one of the coal mines of the place. Though firing at first, he soon mastered the management of the system, and was promoted to engineer in chief, which position he occupied seven years.

At the end of that period he came to Boston, being connected some time with various steam interests, among which may be mentioned the plant at Hotel Brunswick, later being offered the position which he now occupies at No. 28 School Street, where for two years he has continued to make valuable improvements. He has full charge of a thirty-five horse power Hanford engine, and two forty horse

power Kendall & Roberts boilers. Mr. Buchanan is well and favorably known among the engineers of the city, and in point of efficient management, his plant is second to none.

MR. ISRAEL WEBSTER was born in 1841, in Nottingham, England, where he attended school until about fourteen years of age, when he began life in the service of steam as fireman in one of the large establishments of the kingdom, where for six years he remained a valued employé. On the uprising of the North, he came to this country and entered the service of the Union, returning home in about three years, where he once more took up his work in his chosen calling. In 1881, he again crossed the ocean and for some time was connected with various steam interests in this city. About four years ago, he was offered the position of engineer at the well-known lumber dressing Mill of S. H. L. Pierce, of South Boston, where he has remained most efficiently conducting the service and augmenting his system, which consists of one forty and one thirty horse power engine, and a hundred horse power boiler. Mr. Webster is a member of the society of Forresters, and is a very successful engineer.

W. C. MOORE, ESQ., was born in 1839, in Nova Scotia, where he attended the public school until he went to work. He first became interested in cabinet making, which occupation he followed over fifteen years, meanwhile using much of his time in the study of the construction of engines and the practical workings of steam.

Naturally mechanical in his inclination, he deduced many things which he had not the opportunity to put in practice until he abandoned his former trade for the more congenial work of an engineer. While in the cabinet business he was for some time with the Mason and Hamlin Organ Company, but the past fourteen years he has given his attention entirely to steam work, and the results fully demonstrate his ability.

He has recently entered upon new duties at the plant of Hall & Co., in City Square, where already he has incorporated many improvements and augmented the system to a large degree. He has one thirty horse power boiler and a thirty horse power engine.

Mr. Moore is most efficient, and his name is well known among the engineers of this city.

MR. ROBERT TOBY was born in 1845, in the old town of Roxbury, where he attended school until, at an early age, he went to work for himself. He has been connected with many of the large establishments of the country, and for some time was interested in steam-boating.

Lately, his labors have been largely in the line of electric lighting, being at present first assistant engineer at the Edison Electric Lighting Station. He is a most thorough mechanic, and is well and favorably known in his profession.

J. H. THURBER, ESQ., was born in 1840, in East Burke, Vt. Being obliged to go to work at an early age, he left school at fourteen and entered a machine shop, serving his time in St. Johnsbury with the Hastings Manufacturing Company, where he remained three years. On completing his time

there he went to Windsor, where for some time he was connected with the Windsor Manufacturing Company, after which he was secured by the well-known Putnam Machine Company for their works at Fitchburg, where for the long period of thirteen years he remained a valued employé.

At the time of the organization of the Union Machine Company he entered their works, but after three years resigned in favor of general work in the way of constructing engines throughout the country, after completing which, for about a year, he assumed charge of the electric light plant in Brookline.

A short time since, he was secured by the management of Hotel Boylston to conduct their steam service, and has already made many valuable improvements. The plant consists of three sixty horse power boilers and a large heating apparatus.

Mr. Thurber is a Mason, being connected with the Thomas Royal Arch Chapter and Jerusalem Commandery.

He is very efficient in his management and has gained a worthy reputation among the prominent engineers of the city.

MR. DANIEL HANSON was born in 1822, in County Stafford, England, where his education was acquired. He remained in his native land until about twenty-six years of age, serving his time with James Watt & Co., near Birmingham. On coming to America, he entered the well-known works of Walworth & Nason, where he remained the long period of twenty-nine years. At that time his services were secured for the plant in the New York Mutual Life Insurance Building in Post Office Square, where for over nine years he has continued in full charge, constantly improving

his system and increasing its service. The plant consists of two pair of thirty and two pair of twenty horse power Hanaford Patent engines, and three forty-five horse power boilers. Mr. Hanson has been in the service of steam many years, and is well known among the engineers of Boston.

MR. FRANK H. COUPAINE was born at Lisbon Palace, Cuba, where he lived until about five years of age, when he was sent to America to be educated and was placed in the schools of old Salem, graduating with honor at the Salem high school.

At that time, having a desire to enter upon some work for himself, he came to Boston and served his time at book-binding, remaining eight years. He next returned home, but after two years again came to this country on a short visit and becoming interested in mechanics and later in steam, concluded to perfect himself in its general workings, and was soon in charge of the plant at No. 8 Exchange Place, where the past six years he has manifestly proved his skill.

The plant here consists of the usual boilers and general heating apparatus. Mr. Coupaine is a brother of the wealthy Cuban Planter of the same name, who is so well known to importers of tobacco, and today holds an enviable reputation among his colleagues.

MR. FREDERICK E. PETIER was born in 1852, in Charlestown, attending the public schools of that place, Somerville and Cambridge, until fourteen years of age, when he went to work for himself. He first learned the trade of a wood turner and for four years was a valued employé, at which

time he was given charge of the machinery at the establishment of Shaw & Appleton, continuing in this capacity about six years.

He was next interested in the pumping engine at Medford, which discharges two hundred thousand gallons per day, after which he assumed charge of the system at the Boston Bridge Works of D. H. Andrews, where the past five years he has so ably demonstrated his ability.

During the last ten years he has also been connected with the Cambridge fire department in the capacity of assistant engineer. The plant of which Mr. Petier has charge consists of a twenty horse power engine, and a thirty horse power boiler. In politics he is a Republican and is well known among the city engineers.

MR. MATHEW LEARY was born in 1842, in the old town of New Bedford, where he was a constant attendant at the public school until fifteen years of age, when he began life for himself. Although desiring a position in some mechanical line, opportunity did not present itself, and for some time he was obliged to be contented with what he could find to do in various callings. About that time the war broke out and he entered the service on one of the transports as fireman, where he remained three years. On his return to Boston he went to the large and well-known confectionery establishment of Forbes, Haywood & Co., on Sudbury Street, to learn the business, but manifesting such a mechanical turn of mind was given the engine which for the long period of ten years he has ably had full charge. The system consists of one fifty horse power engine and two sixty horse power boilers. Mr. Leary is among our most prominent engineers, and has been in the service of steam many years.

GEORGE DAVENPORT, ESQ., was born in 1829, in Portland, Me. When but three years of age his people removed to Newburyport, Mass., where he was placed in the public school, which he attended until twelve years old when he started out in life for himself, working on the farm until attaining his majority.

At that time he decided to try the sea and shipped for California, going round Cape Horn and visiting the islands of Juan Fernandez and many other well known places, after which he returned to Newburyport, connecting himself with the Newburyport Gas Company as general hand, remaining four years.

At the close of his labors there he came to Boston and entered the works of the Walworth Manufacturing Company, where for about five years he remained a valued employé.

On the breaking out of the Rebellion he enlisted in the Forty-Eighth Massachusetts Regiment, and did gallant service in many of the important engagements. About a year ago he was offered the position of engineer in chief at the establishment of Sumner & Goodwin, where he has full charge of a fifteen horse power engine and a twenty-five horse power boiler. Mr. Davenport is a prominent member of Post No. 49 of the Grand Army of the Republic of Newburyport, and is one of the best known engineers of the city.

MR. H. P. MELLE was born in Wayland, where he attended the district school until about fifteen years of age when he entered the Wakefield Rattan Works, where he remained three years. During that time he had improved his leisure moments in the study of mechanical works, and on the close of his labors there entered a machine shop where he served his time, afterwards going to the Para

Rubber Works at South Framingham to assist in establishing their plant, remaining as engineer some two years.

When his work there was completed he went to the well-known creamery of C. Brigham & Co. for about the same length of time. Later, desiring to see more of the country, he went West assuming charge of a large thrashing machine in the grain country. On his return East he was first connected with the works of the American Rubber Company, where he assisted in setting up a four hundred horse power engine, after which he was detailed to establish the plant at the Youths' Companion building where he is still perfecting the arrangements of the system, and placing it on a higher plane of excellence.

The service consists of one Brown eighty horse power engine and two eighty-five horse power boilers. Mr. Mellen is prominently connected with the Knights of Honor, being a member of the Tremont Lodge, and is among the rising engineers of the city, already having acquired a flattering prominence among his colleagues.

WILLIAM BOYD, ESQ., was born in 1826, in Genoeck, Scotland, where his boyhood days were spent. On growing to man's estate he evinced a desire for a larger sphere of action, and accordingly betook himself to Glasgow, where, until he was about twenty-one years old, he was interested in various things.

On coming to this country he entered the New York Sugar Refinery, where he remained two years, after which he began work in a large boiler manufactory where he remained the long period of ten years. He next was interested in the distillery of Edward Chamberlin at East Cambridge, where he remained eleven years, at the expiration of which he came to

the Ames estate, 521 Washington Street, having full charge of the plant for the last three years, ably demonstrating his ability and continually making improvements in the service. In politics Mr. Boyd is a Republican, and takes a lively interest in all about him, being a genial gentleman and well versed in the principles of his profession.

Mr. J. G. BARNES was born in 1835, in Bakersfield, Vt., where, in the district school, he obtained the rudiments of an education, later going for one or two terms to the village high school.

When eighteen years of age he commenced work for himself in the tin and sheet iron business which he followed over twenty-two years, during which time he was employed on work in his line among engineers. He therefore acquired a good knowledge of the general workings of steam long before he assumed the duties of its master, and when in 1874 he was offered the position which he now holds as engineer at the G. H. Haley Estate, No. 50 Chauncy Street, he was fully prepared to conduct the plant and carry out the many well-founded theories of improvement which he had evolved in the preceeding years. The system here consists of two engines and a twenty horse power sectional boiler. Mr. Barnes is a most efficient and conscientious engineer, and is an honor to his position.

G. W. TOWLES, ESQ., was born in Staford County, Va., in 1846, on one of the largest plantations of the South, where he remained until about fifteen years of age, when he entered the service of the Union for the freedom of his fellow men.

While there he became attached to one of the officers, Captain Smith, of Company B of the first regiment of Massachusetts, and accompanied him on his return North.

The Captain was much interested in his charge, and as he had manifested a most remarkably bright and active disposition, secured for him a position in his own engine room, where for two years he remained a valued assistant.

On completing his labors there he went to the Riverside Press at Cambridgeport, remaining eight years, after which he was secured by the American Fire-proof Safe Company to conduct their plant. He was next with the well-known J. W. Wilson & Co. over eight years, and later, for about the same length of time, with the G. L. Damon Safe Company. About three years ago he was offered the position of engineer in chief at the John Foster estate on Broad Street, where he has full charge of one forty horse power engine and a sixty horse power boiler.

Mr. Towles is most efficient in his labors, and his long and varied experience places him in the front rank of our city engineers.

Mr. W. B. DAVIS was born in Waldoboro', Me., in 1838, where he attended the public school until fifteen years of age, when he entered the service of steam, coming about three years later to Boston where he entered the works of the Whittier Machine Company, and after serving his time was offered the position of engineer at the Areated Bread Works, where for ten years he ably conducted the plant. On the completion of that time he went to the works of the Grover and Baker Manufacturing Company in the same capacity, where he remained two years, after which he was connected with one of the largest tanneries in New England, but later returned to his old position at the bread works. Three years ago he came to the S. A. Woods Machine Company, since which time he has augmented his plant and continually in various ways improved the service.

The system consists of a forty-five horse power engine and two sixty horse power boilers. Mr. Davis is a thorough mechanic and stands high in his profession.

MR. F. C. BROOKS was born in Holland, in 1835, where he attended the schools of his native place until about thirteen years of age, when he shipped before the mast, and for over twenty years followed the sea, going to all parts of the world and visiting nearly every clime. During the war he was in the service of the Union on the steamships "Colorado" and "Sacramento," then going to Valparaiso and Chili as fireman on a steamer, later being promoted to engineer, having full charge for three years of a tug boat in Peru. On coming to Boston he was offered the position which he now occupies at the Howard Iron Foundry in South Boston, where for fourteen years he has ably conducted the service, making many valuable improvements and amply demonstrating his ability. The plant consists of a twenty horse power engine and a twenty horse power boiler. In politics Mr. Brooks is a Republican, and occupies a prominent position among his brother engineers.

Mr. J. WEIGLE, JR., was born in Bavaria, Germany, in 1847, where in the public school he manifested more than ordinary skill in mechanical things. When about nine years of age his people, for political reasons, came to America, and he at once entered the city school where he remained an apt pupil until he was about twelve years old, when he went to a large box factory, serving three years. This, however, proved unsatisfactory, and he entered the Bay State Rolling Mills where he was connected with the blacksmith shop, going

four years later to the machine shop where he remained six years, at the close of which his services were secured by the New England Iron Company at Readville, from whence he went to the Norway Steel and Iron Company, remaining with them three years.

On completing his time there he was connected with the Globe Nail Works, starting their rolling mill and running it two years. He then returned to the Bay State Iron Company and superintended the construction of their sheet mill, after which he began business for himself. Had the rascality of a partner not surmounted his plans, his success would have been commensurate with his ambition ; however, what perhaps proved a loss to him conduced to the good of others, as his valuable services were secured by the Globe Horse Shoe Nail Company, at which place he remained until about four years ago when he came to his present position, at No. 312 Dorchester Avenue, which he has acceptably filled. The plant here consists of a small boiler and a twenty horse power engine. In politics Mr. Weigle is independent, and his superintendence and general management of his plant places him among the prominent engineers of Boston.

MR. HOWARD E. STORER was born in 1861, in Robinston, Me., where he went to the district school until going to work for himself. On the death of his father he at once, although only fourteen years of age, entered the mill, and for three years assumed charge, continuing it in successful operation. He then came to Boston, where he entered the works of the New England Machine Company, remaining two years, after which his services were secured by the McLaughlin establishment, at which he continued four

years. About two years ago he was offered his present position of chief engineer at the well-known Riedout lumber dressing mills where he has introduced many valuable improvements, and to-day the plant, which consists of a sixty-five and a one hundred horse power boiler and a one hundred and twenty-five horse power engine, is second to none. Mr. Storer is a member of the the order of the Iron Hall, and is prominent among our masters of steam.

MR. DANIEL SULLIVAN was born in 1842, in Boston, where he remained in the city school until about thirteen years old, when he entered the chemical works of Henry Thayer & Co. By constant application and persistent effort he gradually worked up to the position of fireman, and in due time was given full charge of the plant, which consists of two fifty horse power boilers and a thirty-five horse power engine. Mr. Sullivan has amply demonstrated his ability, and his success is only a just reward for his labors, which have placed him among our prosperous engineers.

JOSEPH FOSS, ESQ., was born in Dixfield, Me., where, until sixteen years of age, he prosecuted his studies in the public schools, at which time he entered in earnest upon work for himself on the farm, remaining there until about twenty years old, when he went to Newton and entered a large cotton mill, staying there until 1852, when he engaged in the service of the Boston and Providence Railroad as fireman, continuing two years. On completing his labors there he was secured for the large marble works of A. Wentworth, and for about the same length of time remained in successful charge, resigning in favor of general

work in the construction and setting up of engines and steam plants, after which, for a short time, he returned to the marble works, when he was soon offered his present position at the Page box factory, where, for the long period of twenty-nine years, he has continued in full charge. The plant consists of one one hundred and twenty-five horse power Brown engine, and two eighty horse power boilers. Mr. Foss is a prominent member of the American Society of Steam Engineers, and his plant, in point of efficient management, is second to none.

MR. WILLIAM M. SWINERTON was born in 1838, in Newfield, Me., where the public schools afforded him a limited education. Going to work at the early age of ten years he addressed himself at once to steam, and at seventeen secured a position as watchman on a locomotive, where he remained one season, after which he was promoted to fireman, and for seven years continued in this capacity, at which time he assumed full charge of a locomotive, and for four years faithfully performed his duties. On the completion of his labors there, he went to Fitchburg, where, for eight years, he was in full charge of a large stationary plant, which position he resigned in favor of his present one in the well-known lumber dressing mill of Leander Greeley, and during the last ten years he has inaugurated many improvements in the system, which consists of two forty horse power boilers, and one eighty horse power engine.

Mr. Swinerton is an Odd Fellow, and is prominent among our engineers.

HORATIO ROBERTS, ESQ., was born in Cape Elizabeth, Me., Nov. 8, 1832, and in that town received a common

school education. At the age of sixteen he started out in the world for himself and in Portland learned the trade of a blacksmith with Abraham Libby, giving his best labor and undivided energy to the interests of his employer. After acquiring a full knowledge there he went to the machine shop of Benjamin Brown and after a year or so of service in that place, came to Boston and secured a position as engineer with Corruth & Barker, where for two years he had charge of a stationary engine and all kinds of machinery. The next seven years, until April, 1861, he was engaged in running and repairing low pressure engines and boilers. At that time the war broke out and like a true patriot as he was, he enlisted in Company H, First Massachusetts Infantry Volunteers as first Sergeant, and for three years continued in that capacity. During the war he served in various positions, and at the battle of Bull Run, Aug. 29, 1862, his left leg was shot off and the bone of the right one fractured, but nothing daunted by this terrible misfortune, he continued in the service until July, 1866. In November of the same year, the position of chief engineer at the Boston Custom House was tendered to him, and for the long period of twenty years Mr. Roberts has ably and acceptably filled the position. The system consists of two forty horse power steel boilers, one six horse power steam pump and one elevator.

MR. WILLARD M. CARTER was born in Northampton, Mass., Oct. 7, 1829. After gaining an education he learned the trade of a machinist at the shop of the Aldrich Tool Company in Lowell, and at seventeen was a journeyman. At that time he went to Lawrence and for two years worked at his trade, after which he was engaged in New Jersey a

short time and from there went to Manchester, N. H., where he worked on the "Washington," the first locomotive built in the place. After completing his service there he came to Boston, and while at the Hinckley Locomotive Works made and attached the first links ever put on a locomotive in this country. He was one of the prime movers to agitate the ten hour system and bring it into effect. He next went with the Putnam Machine Company, of Fitchburg, but soon was secured by John Souther to take a locomotive West. After disposing of that he returned to Boston and was in various places until the time of Lincoln's inauguration, when he went as engineer to the Custom House, where he remained three years. In 1863, he again resumed his trade with Hittinger & Cook, in Charlestown, after which he was engaged in McLaughlin's establishment. He then started a machine shop in East Boston with J. A. Maynard, doing steamboat repairing, and building engines until some time later, when, giving up business for himself, he was employed as engineer at Buckman & Raynor's, on Pearl Street, whose establishment was destroyed in the great fire. At that time he again started in business in the trade of engines, located at No. 75 Hanover Street, but after a time gave it up and was engaged on the Boston, Revere Beach and Lynn Railroad, and was the first one to run passenger cars over the road. On account of poor eyesight he was transferred to the ferry-boat of the same company, but resigned the latter position to accept that of engineer at the J. S. Paine Furniture Factory, where he remained eight years. He then assumed his present duties, as engineer in the building of Faxon & Elves, at 105 Summer Street.

Mr. Carter has had a varied experience, which has fitted him to occupy the position, and he is recognized as one of our prominent engineers.

MR. F. C. BROWN was born in Cape Elizabeth, Me., in 1845. Inheriting a mechanical genius, he, of course, followed the dictates of his inclination, and at the age of sixteen entered the steamship service of the Boston, Norfolk and Baltimore line as oiler, and after serving two years, was promoted to the position of assistant engineer. In that capacity he was engaged five years, during which time the Rebellion broke out, and he took charge of the steamer "Clarion" bound for North Carolina, from that was made chief engineer of the "Charles Houghton," plying between Jacksonville and other stations on the St. Johns River. He was on various boats during the war, among which was General Butler's famous gunboat "Saxon." At the close of the strife he entered the merchant marine, but after a time was secured for the Portland Rolling Mills, where, for over ten years, as chief engineer he rendered valuable service. He has been connected on various harbor boats, and now holds the position of chief engineer of the Western Union Telegraph Company's steam plant, at No. 109 State Street. It consists of one large tubular boiler, two engines, one steam fire pump, and thirteen large radiators.

Mr. Brown has been a licensed engineer twenty-three years, and his name stands on the books of the United States Local Inspector clear of all charges. He is a faithful, conscientious and obliging gentleman, ever ready to further the interests of his employers, and stands conspicuous in many worthy and prominent undertakings.

MR. MARTIN J. COOKE was born in Souheigan Village, N. H., in 1847. His parents removed to Boston when he was very young, and in a short time sickness and death

entered the family, and he was sent to Palmer, where, until twelve years of age, he pursued his studies. At the end of that time he returned home, and when not at school assisted his father. He had naturally a passionate love for the sea, and of course was attracted to the wharves, where he became acquainted with the boatmen, and at odd hours rendered various services to them for a small compensation. He soon felt he must try the sea, and at sixteen was employed as one of the crew of the yacht "Wm. S. Thatcher," running to Rainsford Island, at that time a State hospital. After about a year's service, he was promoted to the position of fireman on the United States engineer's tug "Tourist," and afterward went as deck hand on the steam yacht "Grace Irving," under Capt. G. F. Brown, who is today considered the pioneer captain of Boston excursion steamers. He was then engaged as fireman on steamboats doing duty in the harbor, in the way of improvements and attending on the forts. He then engaged with G. W. Townsend, to run a small engine on a boat which was to remove obstructions in the harbor, and also to do submarine work in different parts of the country, such as New Haven, Conn., Albany, N. Y., Long Branch, N. J., and in the Chesapeake Bay, and for seven or eight years, he worked either under water, or blasting rocks and ledges, but tiring of this, again went on the steamboat line, in various capacities, until he went before United States Inspector, and procured his certificate as engineer. Two years ago he secured the position of engineer for H. S. Polsey, wholesale confectioner, at No. 78 Merrimac Street, and has, during this time, demonstrated his ability by the good result of his constant endeavor to improve the system.

MR. HENRY HEYMAN was born in 1853, in New York City, where he attended the public school until he went to work for himself at an early age. He was first interested in a large furniture factory four years, coming in 1870 to Boston, being connected with various steam interests for two years, at which time he entered the Boston Fire Department as hoseman on No. 3, which position he occupied eight years, being then promoted to assistant engineman on No. 28, and later was given full charge of Engine No. 22. Mr. Heyman is a most genial gentleman, and is always interested in all improvements in the service. He is one of the best known enginemen in the city.

MR. C. W. RUGG was born in Braintree, in 1839, where he attended the public schools until he went to work for himself at an early age, on the farm, but naturally of an ambitious disposition, that proved unsatisfactory, and he made arrangements which enabled him to serve his time in one of the machine shops of Northfield. In 1859 he came to Boston, and about one year later entered the Boston Custom House as engineer in chief, where he remained some time. During the war he was on one of the well-known steamboats as engineer, and was in most of the important engagements. On his return North, he was for some time engaged in agriculture in Maine, but in a few years came back to Boston and accepted the position of engineer at the Riverside Press in Cambridge, where he remained over six years, resigning in favor of the New York and New England Railroad, on the completion of which work he came to his present position at the large organ works of Mason & Hamlin, where for four years he has continued in full charge, making many valuable improvements, and

largely augmenting his plant. He is a member of St. Paul's Lodge, Cambridge Chapter of Free and Accepted Masons, and is prominently connected with Post No. 30 of the Grand Army of the Republic. His plant consists of one two hundred and fifty horse power Brown engine, and two one hundred and fifty horse power boilers. He is a most efficient and conscientious engineer, and conducts his system with marked ability.

MR. FREDERICK PETERSON was born in Sweden, and devoted himself to the work about the farm until attaining his majority, when he entered a large iron foundry under the superintendence of his father, where he remained until he accepted the position of foreman in a neighboring establishment of a like character. In 1873, desiring to look about in the world, he came to America and assumed charge of the plant in Bennett's lumber 'dressing mill, where he remained five years. About seven years ago he was secured for the large planing mills of Manson & Brothers, and during this period he has continually improved the service of his plant, which to-day stands second to none in the city. He has charge of one one hundred and twenty-five horse power boiler, and a sixty-five horse power engine. Mr. Peterson is among our best engineers.

MR. JAMES MERCER was born in 1853, in London, England, where he attended the national schools until fourteen years old, when he was apprenticed to a well-known boiler maker where he served his full time of three years. On completing his apprenticeship he became interested in an engine, and at once entered upon work which gave him a

thorough knowledge of this machine. When about twenty-six years of age he came to America, and on his arrival at once entered the repair shops of the Boston and Albany Railroad, where, for over six years, he has been in uninterrupted prosperity. His plant consists of a sixty horse power Wheelock engine and a sixty horse power boiler. Mr. Mercer is a most efficient and progressive engineer, and is an honor to his profession.

MR. ALBERT BROOKS FRY was born in New York City, March 3, 1858. Being the son of Major J. W. G. Fry, U. S. A., he was educated as a mechanical engineer, in preparation for Columbia College, but left New York before becoming a graduate of that institution.

After being employed on the coast, and in several cities in New England, he came to Boston in 1880, and entered the well-known Globe Nail Works, where he remained until 1881, when he was offered the position of assistant engineer-man on engine No. 26, which he occupied until October, 1883, when he was elevated to first engineman, remaining until May, 1886, when he was removed, and appointed engineer in chief of the plant in the United States Post Office and Sub-Treasury Building, at which time the *Fireman's Journal of New York* contained the following editorial:—

“The appointment of Engineman Alfred B. Fry to the chief engineership of the Boston Post Office Building, at a salary largely in excess of that he formerly received, is an appointment which all will agree was given wholly on its merits. He was a skillful engineer, both in theory and practice, of years experience in the marine and stationary engine service, as well as nearly five years service with

steam fire engines in this department, of which he has made a most thorough and complete study, thus placing him to the first rank of his profession, as his papers well show. These qualifications, together with a collegiate education as an engineer, give him a high standing in ability to perform his new and responsible duties as chief engineer of that large building with its several engines, boilers, hoisting and electric machinery, all of which are in his complete charge, and for which he is held responsible. May success reward his merits."

He holds a United States certificate as marine engineer, and while in New York served on the National Guard. He was also one of the earliest members of the American Rifle Association, and a frequent winner in many matches, and was prominently connected with some of the social and athletic clubs, being well known in yachting circles, and participating in many races with the yachts, "Fannie" and "Josline." He is a member of the Massachusetts Lodge of Knights of Honor, a charter member of the Boston Machinists Assembly, K. of L., and of several other military and civil organizations. He is one of the most able engineers of the city.

For description of plant, see pages 42-43.

MR. F. P. SMITH was born in 1849, in County Waterford, Ireland. He was connected some years with the steamboat line between New York and Aspinwall, and later with the Baltimore and Savannah line from this city. About four years ago he assumed charge of the plant at the well-known Sturtevant planing mills in East Boston, where he has introduced many improvements which have placed the plant on a high plane of excellence. It consists of a one hundred

and fifty horse power boiler and a one hundred horse power engine. Mr. Smith is thoroughly familiar with both marine and stationary engines, and stands among our best engineers.

MR. G. E. WEAVER was born June 22, 1834, in Belgrade, Me., where his education was obtained, after which, wishing a larger field of action, he came to Boston and engaged with the Roxbury and Boston Laundry Company. After some time he was offered a position by Chickering & Sons, pianoforte manufacturers, at which place his labors were very successful, but after a few years having an offer from the Somerville Dry Clay Brick Manufacturing Company, he resigned his former position and accepted their proposal, and during his stay with them rendered valuable services. For the next few years he had charge of the steam systems at various large establishments in the State, among which may be mentioned Fox & Bacon of 45 and 46 Kingston Street, this city, and the tack factory of Hobart & Son in South Abington. At this time he had a desire to visit the Great West, and accordingly went to Sagamore Creek, Ill., where he engaged in a saw mill, but in 1874 he decided to return to New England, and for three years after that was with the Lee Manufacturing Company at the Highlands. At that time he resigned in favor of a position as engineer offered by J. A. Robertson, located on Furnace Street, at which place he remained three years.

In 1880 he was secured by the G. W. and F. Smith Iron Company as engineer of their extensive steam plant, and for the past six years he has made many improvements, and in discharging his duties has abundantly proved his capability, and won for himself a prominent position among the engineers of this city.

MR. C. A. FITZGERALD, engineer at the Oliver Ditson estate, Washington Street, was born in St. Johns, New Brunswick, in 1854, where he attended school until about seventeen years of age, when he came to the States in search of employment. He served his time at plumbing and pipe fitting with William Wallace & Son in East Boston, where he remained six years, after which he learned the trade of a blacksmith at which he worked some time. At this juncture, business in the States being somewhat depressed, he returned to St. Johns and for several years was prominently connected with a well-known steam concern of that place. On completing his engagement there he again came to Boston and began work on a marine engine for the Glendon Company, with whom he was connected some time, on shore, in the machine shop, and in general marine work. At this time Hotel Glendon on Columbus Avenue was nearing completion, and he was detailed to superintend the steam fitting, and afterward was given charge of the plant at which duty he remained until about three years ago when he came to his present position, which he acceptably fills, having charge of three boilers and as many elevators, with general machinery appertaining to the same. Mr. Fitzgerald is well known among our engineers, and has earned a desirable reputation.

MR. P. H. HOGAN was born in West Newbury, Mass., March 15, 1859, and was educated in the public school of the place. When the time came for him to choose his vocation in life, his mind at once turned instinctively to steam, and he accordingly began the task of studying its principles and mastering its practical workings. In 1883 he was fully competent to accept his present position as

engineer in chief at the buildings of the Massachusetts Institute of Technology. The plant consists of four horizontal tubular boilers, one Porter-Allen eighty horse power engine which furnishes power for cotton and other experimental machinery, and also drives a twelve foot blower supplying eighty thousand cubic feet of air per minute to the forty rooms in the new building. The air is first heated by passing through a coil containing nine thousand feet of one inch pipe, and again by passing through a supplementary coil at the bottom of each flue. He also has under his care one sixteen horse power Harris-Corliss engine which is used mostly for experimental purposes, one Swain turbine wheel and one five horse power Ames oil engine, both of which are used for experiments. There are, besides, many other machines and appliances which are required for the varied works in the building. Mr. Hogan is a conscientious man, and is continually studying to improve his system, and, in the bright future before him, will surely reap the reward of his present endeavors.

MR. H. C. BROOKS was born in Owego, N. Y., in 1882, where, until going to work, he attended the district school, manifesting a quick and receptive disposition. When twelve years old he entered a cotton factory, and for two years performed his duties with unusual promptness. He next went to Fitchburg, Mass., and being interested in mechanics entered the works of the Putnam Machine Company, where he served his time. In 1849 he entered the service of the Massachusetts Central Railroad as fireman, and in a short time was given an engine which he ran until 1852, when he went to South Carolina, where he remained fourteen years superintending the construction and

erection of steam plants throughout the South. At the close of the war he came North, and until 1873 was interested with his father in moving buildings in Boston, after which he went to Chicago where he was engaged in steam work about two years. Six years ago his services were secured by Preston & Merrill for their well-known works on Washington Avenue, South Boston, where he has inaugurated many valuable improvements in the system, which consists of one sixty-five horse power Harris-Corliss engine, and two sixty-five horse power boilers. Mr. Brooks is a Democrat and a Mason, and is one of our prominent engineers.

MR. LAWRENCE J. CRUMMIE was born in 1858, in Ireland, but came to this country when quite young and at once entered the public school which he attended until reaching the age of ten years, when he began work for himself. After advancing in years he entered the service of the Boston and Albany Railroad as fireman, remaining four years, after which he entered the Bay State Rolling Mills where he was connected about three years. On completing his work there he was secured by George Miles to superintend the plant in his well-known works, and for over four years he has continued in successful charge continually improving his system. It consists of one forty horse power engine and a sixty horse power boiler. Mr. Crummie is a Democrat, and is doing good work in the service of steam.

MR. S. POWERS, was born in 1842, in Newfoundland, where he obtained his education, coming to the States when quite young. He went to work at an early age, and at

once became interested in steam, being associated for sixteen years with the merchant marine as an engineer. About three years ago he assumed the duties of engineer in chief at Hotel Oxford on Columbus Avenue, and in this time has amply demonstrated his ability, having by his untiring efforts placed his plant on a high plane of excellence. Mr. Powers has charge of three forty horse power boilers, one engine, three elevators and a large heating apparatus, and is well known among our best engineers.

MR. P. MAGEE was born in 1850, in County Dunn, Ireland, where he received his education and served his time. He came to America when twenty-one years of age, and at once entered the employ of Curtis, Davis & Co., the well-known soap manufacturers, where, for the long period of fifteen years, he has continued in uninterrupted prosperity. He has charge of a large plant, and in point of efficient management it holds a high position. Mr. Magee recognizes the responsibilities of an engineer, and is ever striving to conduct his system on the best known principles, and his conscientious and untiring labors have been rewarded by the elevated standard which his plant has attained.

MR. JOSEPH M. GREER was born in 1854, in St. Johns, N. B., and attended school until going to work at twelve years of age. He was first apprenticed to a carpenter with whom he served five years, after which he came to the States. In 1881 his services were secured by Stilman & Nicoll for their plant on Tremont Street, where, during the past five years, he has remained faithfully discharging his daily duties. The plant there consists of a twenty horse

power engine and a twenty-five horse power boiler. Mr. Greer is conscientious in his work, and being ever alive to the improvement of his plant is always studying to that end, and has a bright future before him.

MR. JAMES W. TEAGUE was born in 1841, in Portsmouth, N. H., where he attended school, after which he served his time in the machine shop of the Concord Railroad, where he remained four years. Later he had charge of the steam system at the Kearsarge cotton factory, being master mechanic eight years. He was next connected with the Eastern Railroad in the machine shop for some years, after which he came to Boston and entered the employ of the Boston and Providence Railroad. On completing his engagement there, he was offered the position of master mechanic on the Boston, Revere Beach and Lynn Railroad, which he ably filled about two years, when he went to the Boston, Winthrop and Shore Railroad, and remained about the same length of time. At the end of that period he assumed charge of the plant of the Bebee estate, later being connected with Geo. K. Paul and other well-known manufacturers of steam appliances. At that time he became interested in locomotives, and for two years was in the South and West in the interests of some of the largest railroads of the country. About one year ago he was secured by Ivers & Pond for the plant in their factory, where he has charge of a one hundred and twenty-five horse power Brown engine and two one hundred and twenty-five horse power boilers. Mr. Teague is one of the ablest and most prominent of our engineers.

J. H. F. SMITH, ESQ., was born in 1853, in Eastham, Mass., where he was a constant attendant at the district school until fifteen years of age when he began work on the farm, three years later entering the machine shop of Cook, Rymes & Co., in Charlestown, where he served his time, remaining five years. He was for several seasons engineer at the Isle of Shoals, but about two years ago assumed charge of the steam system at the works of the Boston Woven Hose Company, one of the largest concerns in their line in the world. The plant consists of a three hundred and forty horse power Buckeye engine, boilers of three hundred horse power capacity, one Thomson-Houston Dynamo with a capacity of a hundred and sixty lights, and a large Worthington fire pump throwing seven hundred gallons of water per minute. Mr. Smith is an Odd Fellow, and is one of the prominent engineers of the city.

MR. R. H. WIGGIN was born in 1848, in Buffalo, N. Y., where he went to school until about fourteen years of age, when he entered a machine shop and served four years. At the end of that period he began firing on one of the railroads of that section, and was soon in charge of a locomotive. He has at various times been connected with the Lake Shore and Michigan Southern, and the Central Pacific Railroads, and many other large and extensive lines. Some time ago he came to his present position at the Vienna Brewery for the purpose of constructing the arctic refrigerator and equipping the plant, which consists of two large boilers, two 22 x 26 steam engines, two ammonia compression engines, two sets of large Worthington pumps 9 x 8½ x 10 displacing fifty tons of ice every twenty-four hours. This ice tank is one of the largest in New England, contain-

ing some fourteen thousand feet of inch and a quarter pipe. Mr. Wiggin is earning an enviable reputation, and today his plant is one of the most prominent in the city.

GEO. H. BRIDGE, ESQ., was born in Boston in 1845, where he went to school until about fifteen years of age, when he entered the works of a well-known shipsmith with whom he served three years. He then entered a machine shop for about the same length of time, after which he went to the works of Joseph Paul where he remained about a year. On completing his labors there he entered the Hinckley Locomotive Works as a contractor, and was associated with them for a period of five years, after which he entered the Boston Fire Department as hoseman, from which position he has worked up to that of engineman, being at present on engine No. 7. Mr. Bridge has been in the department eleven years, and in this time has amply demonstrated his ability for the duties which he is called upon to perform.

MR. JOHN COLEMAN was born in 1839, in County Cork, Ireland, where he remained until about twenty-five years of age, when he came to America and interested himself in steam at the old and well-known establishment of Allen & Endicott, where he has remained twenty-one years, working up to the position of engineer in chief of the steam system, which consists of a one hundred and twenty-five horse power Putnam engine and two sixty horse power boilers. Mr. Coleman has constantly been improving his plant, and in the long period of his service in steam has acquired an enviable reputation as an able and conscientious engineer.

MR. C. J. ERICSON was born in Sweden in 1836, where he lived until 1859 when he came to America. He is engineer in chief at the works of the Boston Fire Brick Company and the Boston Terra Cotta Company, where for the long period of nineteen years he has had full charge of the plant, in which he has made many valuable improvements. It consists of a thirty horse power Putnam engine and a seventy-five horse power boiler. Mr. Ericson has been in the service of steam many years, and today is one of the trusted and practical engineers of the city.

MR. E. H. WISE was born in Boston in 1836, where the public schools afforded him an education. When fourteen years of age he entered the Hinckley Locomotive Works and served his time, after which he became connected with the Central Vermont Railroad, first in the machine shop and later on the road as fireman. After two years he returned again to the locomotive works, where he remained until going on the Boston and Lowell Railroad where he was connected three years as fireman. On completing his engagement there, he was secured as chief engineer for the Roxbury Chemical Works, which position he occupied about two years. This position he resigned in favor of the Boston Planing Mill, later being interested for some time in the oil business. On resuming his labors in connection with steam, he assumed full charge of the plant of Foster & Taylor on Broad Street, remaining fourteen years. He was next with the Roxbury Carpet Company for two years, and then assumed the duties of chief engineer and master mechanic at the Aetna Rubber Works, where he remained until taking the plant at 28 School Street, which he resigned in two years to accept his present position at the

Hemenway estate, where he has had for some time full charge of the plant, which consists of three water elevators on the Hinckley system, one steam elevator, one pair 7 x 8 engines and two fifty horse power boilers. Mr. Wise is an ardent Republican and takes a lively interest in politics. He is also a Mason, a member of the Knights of Honor, a prominent Odd Fellow, and is one of the best known engineers of the city.

MR. OWEN F. MOORE was born in County Dublin, Ireland, in 1862, coming to America when quite young. When fifteen years of age he addressed himself to the serious work of gaining a livelihood, and for some time was interested in various things. Having a natural inclination toward mechanical work, he availed himself of the first opportunity that came in his way to secure a position in this line. From that time onward his success became marked indeed, and his thorough knowledge of his work soon brought him to the notice of Law Bros. & Co. who secured his services for their plant, where for over six years he has continued in full charge. The plant consists of one fifty horse power Chubbuck engine and a sixty horse power boiler. Mr. Moore is a painstaking and conscientious engineer.

MR. JOHN S. BLAIR was born in Scotland in 1849, going to the Provinces when quite young, where he attended school until about seventeen when he began work for himself. He served four years at the machinist trade, after which he came to Boston, where he has been connected with some of the best-known establishments in his line,

among which may be mentioned the Whittier Machine Company, with whom he remained some eight years, resigning in favor of his present position of hydraulic engineer at the Hoosac Tunnel Dock. During the last year he has made many improvements in the plant, which consists of two large hydraulic pumps and four one hundred and fifty horse power boilers.

Mr. Blair is a Mason, being a member of Adelpia Lodge, and is also connected with the Legion of Honor. He is well known among our best engineers.

GEO. A. HENRY was born in Boston in 1843. When about two years of age his father removed to Townsend, where he remained some four years, when, on account of the death of his mother, he was placed with relatives in Mason Village, now Greenville, N. H., where he attended the public school, graduating with honor in the academy at New Ipswich at the age of seventeen. At that time he left home and went to Manchester, where he entered the employ of Stanton Bros. On completing his time with them he went into the steam department of the Putnam Machine Company in Fitchburg, where he remained until the breaking out of the war. He enlisted in February, 1864, in Company F, 57th Massachusetts Volunteers, and served until the close of the Rebellion. On his return he again became connected with the Putnam Machine Company remaining until the spring of 1873, when he resigned in favor of a situation near Boston, since which time he has held various positions requiring care and experience. At the New Orleans Exposition he represented the Brown Engine Company of Fitchburg with one of their largest engines. On his return North the position which he now holds as engineer in chief

at the works of the American Rubber Company was offered him, since which time the plant, which consists of two three hundred and fifty horse power Brown engines, and ten large boilers, has been under his supervision. To furnish the works with heat and power requires about three thousand tons of coal per year. Mr. Henry is one of the most prominent engineers of the city.

MR. THOMAS HAWKINS was born in 1852, in New York City, attending school in Wilmington, Delaware, where his people soon located. At seventeen years of age he entered the machine shop of Harlan & Hollingsworth, where he served five years, at the close of which period he went to China as a machinist in the United States navy. He remained in China about three years, when he returned to America and assumed the duties of assistant engineer on the steamship "D. H. Miller," of the Baltimore Line, where he remained about a year. After being interested in various steam enterprises for some time, he came to the Frost estate on South Street, where, for the past two years, he has had full charge of a forty-five horse power Atlas engine and a sixty horse power Atlas boiler. Mr. Hawkins enjoys an enviable reputation among his colleagues, and his plant, in point of efficient management, stands high among those of the city.

MR. MILES M. HANNA was born in Cumberland County, N. S., in 1853, where he attended school, coming to the States when about seventeen years old. He served his time with the well-known G. W. and F. Smith Iron Company, after which he became connected with John Lally,

later going West for about two years. On his return East he entered the Norway Steel and Iron Works, where, for the long period of seven years, he remained in uninterrupted prosperity. On completing his labors there he was connected with John Souther about three years on general work, from which he came to his present position at 37 Foundry Street, where he has full charge of a seventy-five horse power Putnam engine and an eighty horse power boiler.

In politics Mr. Hanna is a Republican. He is a thorough mechanic, has a comprehensive knowledge of steam, and today is one of the best engineers of Boston.

MR. O. J. CAMERON was born in Newport, Vt., where he attended school until he entered the Sherburn High School, where he remained until about fourteen years of age, when he engaged in a machine shop and served his time of three years. On finishing this work he went on the railroad and followed it in various capacities several years, first as fireman on the Grand Trunk Line. Later he went to the Morton Mills, after which he became connected with N. C. Monson. He was for some time at Groton, Vt., with Barney Ferrin, later having the general superintendence of certain departments of the construction work on the Grand Trunk Railroad. At that time he entered the service of the New York and New England Railroad, where he had been but a short time when he was secured by White, Pason & Co., for their plant on Avon Street, where for seven years he has continued in full charge of two Hanaford engines and two seventy horse power boilers. Mr. Cameron is a Mason, being a Knight Templar and a member of Coeur De Lion Commandery. He is among the most prominent engineers of Boston.

MR. JOHN GESWELL was born in Berkshire, England, in 1840, where he attended the national schools and served his time. He was connected with the Reading Locomotive Works fifteen years, after which he assumed full charge of the plant at Wellington College, remaining five years. In 1870 he came to America and at once entered the Helger Iron Foundry. On completing his engagement there, he came to the Cunningham Iron Works, where, for twelve years, he has successfully conducted the system, which consists of a sixty horse power Brown engine, two sixty horse power boilers, and a super-heater. Mr. Geswell is a most efficient engineer.

CHAS. M. GLIDDEN, ESQ., was born in Cavendish, Vt., in 1825, where, until thirteen years of age, he spent his time in acquiring the rudiments of an education, when he was apprenticed in the navy yard, where he remained two years, after which he followed the sea until 1844, when he entered the Mexican war. Some time later he was in California, but came to Boston in 1859 and became connected with Holmes & Blanchard, where he remained nine years. The following five years he was with Carpenter, Woodard & Morton. About nine years ago he was secured for the plant at the Waverly House, where he has inaugurated many improvements. The system consists of one twenty horse power engine and two eighty horse power boilers. Mr. Glidden has been in the service of steam many years, and is one of our leading engineers.

MR. J. B. SWEET was born in Hants County, Nova Scotia, in 1849, where the schools afforded him his educa-

tion. He served his time in Halifax, remaining two years, after which he became interested for some time in various steam enterprises. Desiring to see more of the world, he entered the merchant marine as fireman, and soon worked up to engineer, going to the West Indies, the Gulf of St. Lawrence, and many other well-known places. On coming to the States he connected himself with the Walpole Emery Mills, but after about two years accepted a position with the Mystic Rubber Company, going ten years later to the Massachusetts States Prison, where he remained over three years. About a year ago his valuable services were secured by the management of the Boston University to conduct their plant in the Claflin Building on Beacon Street, where he has charge of two duplex hydraulic pumps, and two sixty horse power boilers. Mr. Sweet is a conscientious engineer, well known for his efficient management.

MR. MATHEW A. MCCARTY, engineer at factory No. 2 of the Ivers and Pond Piano Company, has for many years been in the service of steam, having been connected with many of the most prominent plants in New England. He was for several years on the Boston and Lowell Railroad, and has been with the well-known Geo. Woods & Co., being in their employ over fifteen years. Mr. McCarty is a member of the Stationary Engineer's Association, and is well-known among his colleagues.

MR. W. F. POUSLAND was born in Salem, in 1848, where he attended the public schools until going to work. When about twenty years of age he entered the machine shops of the Nauemkeag Cotton Company, where for six years he

remained a valued employé. On coming to Boston he became connected with Lewis Osborn, and for five years was very successful in his work on both stationary and marine engines. On completing his engagement there he was offered a position at the Simpson Dry Dock, later being interested in various steam work, when, in 1872, he assumed full charge of the system at the world-renowned pork packing establishment of John P. Squire & Co. The plant consists of an eighty horse power Brown and a sixty and a thirty horse power Kendall & Roberts engine, boilers of about seven hundred horse power capacity, and a large Worthington pump.

Mr. Pousland is a Republican in politics, and is one of the most prominent engineers in the city.

MR. RICHARD S. SIMONDS was born in Winchendon in 1829, where he attended school, later graduating in Chelmsford at the Academy. When seventeen years of age he entered the wooden ware works of his father at Ashby and remained until 1868, when he established a factory in Portland, Me., and later one in Lynn. In 1873 he began to devote his whole attention to the machine business, and for about three years was in the West in the furtherance of his interests in this line, and while there set up quite a number of well-known plants. About twelve years ago he was secured for the system in the Federal Block on Milk and Federal Streets, where he has a fifty horse power Whittier engine and two fifty horse power boilers.

Mr. Simonds is an Odd Fellow, and has conducted his plant with marked efficiency, and to-day it stands second to none in the city.

JACOB ADLER, ESQ., was born in Germany in 1840, and came to this country when about eighteen years of age. He served his time in the old country, and on his arrival in America at once entered a large manufacturing establishment in New York, where his ability soon placed him in the foremost rank of the older engineers of the city. In 1870 he came to Boston and connected himself with the Eagle Sugar Refinery, remaining four years. He has occupied his present position with C. H. North & Co. about six years. He has full charge of an eighty horse power Brown engine and boilers having a capacity of about five hundred horse power. Mr. Adler is a Mason, and has acquired an enviable reputation by his able management of the system under his control.

CLARK B. WOOD, ESQ., was born in Williston, Vt., in 1849. He first began the serious work of life by firing in a Saw Mill of the old Green Mountain State. This being little to his liking, he soon apprenticed himself to a watch maker and jeweler, with whom he remained about three years. At that time an opportunity presented itself which enabled him to become connected with the Singer Sewing Machine Company. He remained with this concern seven years, after which he entered the service of the Old Colony Railroad in their machine shop, from which he went on the road firing a locomotive. On completing his engagements there he was offered a position with Miller Bros., in Somerville, as engineer, and for over three years he remained with this well-known house. Some time ago he was secured by Dickerman & Co., whose factory is on Green Street, for their plant, which consists of engines, boilers, pumps, etc. Since he assumed charge of the system it has shown a

marked improvement, which demonstrates Mr. Wood's efficiency as an engineer. He is prominently known throughout New England.

MR. DANIEL MCELNEY was born in Ireland, in 1844. He first became interested in steam when quite young, and after serving his time became connected with the steamship line whose boats ply between Londonderry and Glasgow. When about twenty years old he decided to come to America, and on his arrival entered the employ of A. Wentworth, and for the long period of twenty-three years he has remained at his post of duty with this well-known firm. The plant of which he has charge is located at 13 Hawkins Street, and consists of one sixty horse power engine and a sixty horse power boiler. Mr. McElney has been in the service of steam many years, and his long connection with one house amply demonstrates the satisfaction which he has given.

W. H. WHIPPEN, ESQ., was born in Boston in 1854, where he attended school until about fifteen years of age, when he entered the service of steam on the Eastern Railroad, first as fireman and later as engineer. He remained on that road over twelve years, during which time he was connected with the stationary work in the shops as well as in running on the line. On completing his work there he was secured by Bagnall, Loud & Co., with whom he remained about a year, when he assumed charge of the plant of the well-known Geo. McQuestion & Co. About three years ago he came to his present position of engineer in chief at the Blodgett estate, located at 256 Purchase Street, where he has brought about many valuable improvements in the

system, which consists of a one hundred horse power Putnam engine and a fifty and a seventy-five horse power boiler. This plant furnishes the heat and power for this large estate, containing thirty-four elevators and three machine shops. Mr. Whippen is one of our most prominent engineers, and in point of efficient management this plant is second to none in the city.

MR. J. S. FRENCH was born in Chesterville, Me., 1826, where the public school afforded him his education. When quite young he began work on the farm which he followed five years. At the end of that period he entered a machine shop and served his time, after which he was connected in Lowell, Lawrence, and in New York City. He was at the Standard Sugar Refinery in South Boston some time, and has occupied the position of chief engineer at the Revere Sugar Refinery for the past seven years. The plant there consists of five large engines and eleven boilers. Mr. French has had many years of experience in steam, and is in the foremost rank of the engineers of our city.

MR. G. A. KEMPTON was born in Uxbridge, Mass., in 1845, where he attended school until the breaking out of the Rebellion, when, with heart fired with zeal, he entered the service in the 1st Rhode Island Regiment, being commissioned as Captain of Company B. He was in the service three years, nine months and ten days, doing gallant work in many engagements. In 1867 he first became interested in steam on the New York, New Haven and Hartford, now the New York and New England Railroad, remaining fourteen years, working up from fireman to engineer. At the

end of that period he became interested in the West and was about two years on the Galveston, Harrisburg and San Antonio Railroad in Texas. Some time ago his services were secured by the management of the Williams Estate, No. 30 Kilby Street, for the superintendence of their plant, which consists of two thirty horse power boilers and a forty horse power engine.

Mr. Kempton is a Mason, an Odd Fellow, and a member of A. G. Warner Post No. 54, Grand Army of the Republic, of Putnam, Conn. He is a most able engineer, and is an honor to his position.

S. S. SMITH, ESQ., was born in Portland, Me., in 1821, where he went to school until eleven years old, when he was apprenticed to a baker with whom he served his time of three years. This, somehow, did not meet his desires, and circumstances arose which called him from the bake-shop to the farm, and the next five years of his life were devoted to the various duties of a farmer. At the end of that period he entered the service of the merchant marine, and for ten years followed the sea, being six years of the time in the United States Navy. When his duties in this line were completed, his attention was called to steam and kindred subjects, and he soon became connected with a large cotton mill in Pawtucket, R. I., afterward going to the New England Homœopathic Hospital as janitor, remaining about a year. From there he entered the machine shops of the New York and New England Railroad, later being with the Woonsocket Machine Company for five years. He came to his present position with C. Blake & Co. about six months ago, and in this time has made many improvements in his plant, which consists of a fifty horse power engine and a

sixty horse power boiler. Mr. Smith is a thorough mechanic, and in his various charges has amply demonstrated his ability as an engineer.

MR. JOHN MORAN was born in Boston in 1861. His people soon after removed to Providence, R. I., where he attended the city school. When sixteen years old he became interested in the dry goods business travelling on the road, in which he remained until about three years ago when he entered the works of the Star Brass Manufacturing Company. He served his time in the shop, but evinced such an aptitude for steam that he was given charge of the small engine which at that time was in the building. Since then his success has been marked. He is continually studying the best works on the steam engine and kindred subjects. The plant under his able direction has steadily improved, having been augmented to a twenty-five horse power engine and a boiler of the same capacity. Mr. Moran has a bright future before him.

MR. JOHN DEWITT was born in Ware, N. H., in 1843, where he graduated at the Village High School. On completing his education he entered a store and served three years. Early in the war he went to the armory at Springfield, where for three years he worked in various departments, and while there, in repairing engines, he first acquired an interest in steam. When these labors were completed he entered the engine works of Woodruff and Brucli, in Hartford, Conn., after which he went to North Carolina as chief engineer for the North Carolina Lumber Company of Boston. He was there two years, when he returned North

and became connected with a builder of engines. He next went to Fitchburg and entered the works of the Putnam Machine Company, where he remained seven years. At the end of this period he came to Boston and took charge of the plant at Hotel Vendome, but resigned in about a year in favor of his present position as engineer in charge of the J. M. Sears Estate at Arch Street, where, for the past twelve years, he has so ably been connected. The plant, which is one of the largest in Boston, consists of one seventy-five horse power Brown engine, three sectional boilers, one eighty inch tubular boiler of one hundred and twenty horse power capacity, and a Sturtevant blower.

This plant furnishes heat and power for nine large printing establishments, among which may be mentioned B. Wilkins & Co., Rockwell & Churchill, Stanley & Usher, Blair & Hallett, James Adams and J. H. Hamilton, two paper ruling firms, four book-binders and forty-five merchantile firms, not including offices. Taken all in all it covers a large territory, bounded by Milk, Devonshire, Franklin and Arch Streets, including both sides of the latter, and touching one side of Hawley Street. Mr. DeWitt has had a large practical experience in the service of steam, and today stands prominent in the foremost rank of our ablest engineers.

HENRY BOLTON, ESQ., was born in England in 1841. On finishing his studies in the national schools he served his time in a large engine establishment where he remained some time. Soon after reaching his majority he came to America, at once entering a Woolen Mill in Conway, Mass. When his labors there were concluded, he assumed charge in a large file manufacturing establishment, and after five years' service went to the Bridgeport Brass Company in

Connecticut, where he was connected a little over a year, returning at that time to the file works. He next went to Croton, N. Y., where he was interested as a mill-wright. Sixteen years ago his valuable services were secured for the Cambridge Rolling Mills, where he has improved and augmented the plant to about three hundred and fifty horse power. Mr. Bolton is a prominent Odd Fellow, and stands conspicuous among our engineers.

MR. C. H. MAYO was born in Steep Falls, Me., in 1854, where he attended school. When nineteen years of age he entered a large cooperage, where he served three years. He then came to Massachusetts, where he has been connected with some of our largest manufactories, being located about four years at one time in Cambridgeport. Seven years ago he came to the steam barrel factory of Goeppers Bros. & Co., where he has instituted many valuable improvements. The plant here consists of one forty-five horse power Porter-Allen engine and a fifty horse power boiler. Mr. Mayo is a Mason, and in the service of steam has amply demonstrated his ability.

MR. BENJ. KING was born in Merrimac, N. H., in 1833. The district school afforded him what education he acquired until he was placed at work on the farm, which occupation he followed with varying success until about thirty-eight years of age, when he entered the service of steam. He has made a thorough study of this subject in all its magnitude, and his experience among some of the largest plants of New England peculiarly fitted him for his responsible position at the works of the New England Glass Company,

where for eight years he has continued with marked success. The plant there consists of a forty horse power Corliss engine and two sixty horse power boilers. Mr. King is most successful in his work, and his name will ever be prominent among our engineers.

L. H. NEWHALL, ESQ., was born in Malden in 1838, where he attended school until sixteen years old, when he began work in the machine shop of his uncle, Otis Tufts, with whom he served three years. On the completion of his time there, he went to the Boston Rubber Shoe Company, remaining ten years, after which he was for two years at the well-known works of G. T. McLaughlin & Co. as fireman, later being for about the same length of time, in the construction department; after that he was with B. F. Sturtevant, and some time later was interested in the manufacture of sewing machines. He has also been connected with the Red Mills Rubber Company, the Nonatum Mills, and the Tewksbury Automatic Elevator Works. About a year ago he assumed his present duties at the factory of the Wait and Watts Furniture Company, since which time he has made various improvements in the plant, which consists of a two hundred and fifty horse power Harris-Corliss engine, three eighty horse power boilers and two large Worthington Pumps. Mr. Newhall is an able and progressive engineer.

R. P. MARTIN, ESQ., was born in Eastport, Me., in 1832. When ten years old he was taken from school and placed out on a farm for seven years. At the end of this period he entered a machine shop where he evinced more than

ordinary interest in his work. He was with some of the best-known establishments of New England until the great Boston fire, when he came to this city and assumed charge of the plant of Macullar & Parker. Seven years ago he came to his present position at Thorndike & Pitman's on Summer Street, where he has charge of two Whittier engines and four forty horse power boilers. Mr. Martin has improved his system to a large degree, and today it stands equal to any in the city in point of efficient management. He is a member of John A. Andrew Post 15, of Boston, Grand Army of the Republic, and is among the prominent engineers of the city.

MR. OTIS GATES was born in Dorchester in 1839, where he attended the public schools until seventeen years of age when he began work on the Old Colony Railroad. He remained with this company eleven years, rising from fireman to engineer. On completing his labors there he assumed charge of a large plant, remaining about a year, after which he entered the Navy where he was connected as fireman about the same length of time. He was next with the well-known firm of Hawes & Hersey, later being connected with Patrick Donohoe, where for three years he was a valued employé. At this time the position of engineer in the machine shops of the Old Colony Railroad was offered him. He remained there three years and then became connected with the Walworth Manufacturing Company, where for nine years he rendered most accepted service. At the end of that period he assumed charge of the Cathedral Building, corner of Devonshire and Franklin Streets, where he inaugurated many valuable improvements. Four years ago his services were secured by Walter Baker & Co. for

the plant in their factory number 2, known as the old Webb mill. The system here consists of one Putnam one hundred horse power engine and three fifty horse power boilers. Mr. Gates is a prominent Odd Fellow, and his years of experience attest his ability in his chosen calling.

MR. JOHN DONELAN was born in Boston in 1845, where he attended the city schools until about fifteen years of age, when he entered the service of the Union, enlisting in Company G, Twenty-fifth Massachusetts Volunteers. He was in the service four years, after which he served his time with his father for about the same number of years. At this time he entered a large steam fitting establishment, after three years assuming charge of the plant at the Codman estate. On finishing his work there he was interested for some time in various steam enterprises, until about two years ago when he came to his present position at Spitz Bros. & Mork, where he has met with good success in conducting his plant, which consists of a fifteen horse power Whittier engine and a forty horse power boiler. Mr. Donelan is a member of Post No. 37, Grand Army of the Republic, and has done good work in the service of steam. He is an able and studious engineer.

MR. C. J. WOLFF was born in New York City in 1853, but came to Boston when quite young and attended the public schools. When ten years old he began to think of earning some money for himself, and soon secured an opportunity to do so shoveling sugar in the Union Sugar Refinery of Charlestown, where his father was engineer. When old enough he assumed the duties of third assist-

ant to his father, and in a short time was advanced to the second position. On completing his engagement there he became connected with the Eastern Railroad where he remained four years, later going to the Winthrop and Point Shirley Railroad. His father, at this time, was in the East Boston Sugar Refinery, and Mr. Wolff resigned his position on the Railroad to assist him in his duties, where he remained some time, resigning at last in favor of the Mason Building. About a year ago he assumed his present position at the Geo. H. Homan's Estate, occupied by Springer Bros. & Co., on Essex Street, where he has charge of a fifty horse power boiler and two large Worthington Hydraulic pumps. Mr. Wolff is a progressive, industrious engineer, and has gained a reputation which is only a just reward for his labors.

MR. LUCIUS P. BARNES was born in Montpelier, Vt., in 1838. He attended school in his native town until about fourteen years old, when he entered the Hinckley Locomotive Works, remaining until 1857, after which he was connected about a year with Ladd & Webster on Lincoln Street. He then went to Lewiston, Me., in the service of the Franklin Water Power Company, where he remained some time. He then went to Northfield, Vt., with the Vermont Central Railroad, and remained until the breaking out of the war, when he enlisted in the First Vermont Infantry. He was with this regiment three months, or until it went out of service, and then enlisted in the 17th Regiment of Massachusetts Volunteers, serving until 1863. On his return from the war he entered the Atlantic Works in East Boston, where he labored on one of the gunboats which was in process of construction for the government.

In 1864 his services were secured by Donald McKay, where he assumed charge of the construction of two monitors for the service. On the completion of these boats he went to Bordentown, N. J., where for two years he was interested in the Camden and Ambury Railroad, later assuming the duties of assistant foreman of the New York Central Railroad, at Albany. At the end of this period he was secured for the same position in the construction of the Hoosac Tunnel, where he remained four years. On the completion of this work he entered the service of the Old Colony Railroad at the repair shops in South Boston in the same capacity. In 1875 he went to the Geo. F. Blake Pump Works, and for three years had charge of the erection department. At that time opportunity presented itself that enabled him to go to Florida, where he was for some time foreman and master mechanic of an extensive Railroad then in process of construction. On his return to Boston he assumed the duties of chief engineer of the Sears Estate on Arch Street, where he remained three years, resigning in favor of the Hoosac Tunnel Dock where he was ably connected some time. Mr. Barnes is at present prominently connected with the American Society of Steam Engineers, occupying a position for which he is eminently fitted by his years of experience in the management of steam.

MR. W. A. WATKINS was born in England in 1863. He came to this country when about eight years of age and entered the public school, where he proved an apt and diligent pupil. In 1877 he became connected with a book binder and served two years. At that time becoming interested in steam he secured a position with J. W. Damrell, later going to the Woman's Prison as fireman. He has also

been connected with Youngs Hotel and the Whittier Machine Works in the same capacity, and was two years with John P. Squire & Co. About a year and a half ago he obtained his present position at E. T. Cowdrey's where he has charge of a twenty horse power engine and two fifty horse power boilers. Mr. Watkins is doing a good work and deserves great commendation for his conscientious labors.



MR. CHAS. E. JACKS was born in Portland, Me., in 1846, where he received a public school education, later graduating with honor at the Westbrook Seminary. At the age of sixteen he entered a machine shop and served three

years. At that time the country was calling on her patriotic sons to protect her unity, and with a heart fired with zeal and bravery, he enlisted in the First Regiment of the District of Columbia as a non-commissioned staff officer, later being transferred to the First Regiment of Maine as Sergeant in Co. A, and was in most of the important engagements of the war. At the close of the Rebellion he went as assistant engineer to the Portland Rolling Mills, where he remained eight years, when he accepted a position offered him to run a flouring mill in Illinois, after which he was connected with a large steam work in Chicago. Desiring to return East, he engaged in a steam enterprise in South Boston, but was soon called to Haverhill, where he remained two years. The Newton Mills Company then secured him as engineer in chief of their extensive plant and for four years he ably discharged that duty. At the end of that time he went to superintend the steam system of the United States Cotton Company at Central Falls, R. I., when after two years, the works being shut down for repairs, he visited this city, but while here being induced by the Boston Steam and Power Company to assume charge of their plant, he resigned his former position and accepted their offer. Mr. Jacks is an emphatically pronounced Mugwump in politics, is a member of the Ancient Landmark Lodge, No. 14, of Free and Accepted Masons of Portland, is prominently connected with the Grand Army of the Republic in Dahlgren Post, No. 2, of South Boston, and is one of the directors and examiner in chief of the American Society of Steam Engineers. The system under his supervision consists of one sixty horse power Brown Engine, one pair of forty horse power Fitchburg Engines, one sixty horse power steel boiler, two eighty horse power sectional boilers and three Knowles and two Blake pumps. This plant furnishes the power and heat for

the buildings in the square bounded by Summer, Kingston, Bedford and Chauncy Streets. Mr. Jacks has rendered most valuable service and untiring effort in conducting his plant, and his rank among the most prominent engineers of Boston has been truly and deservedly acquired.

THOMAS P. LOCKNER, ESQ., was born in the old town of Dorchester in 1849. He attended school until fifteen years of age, when he entered a grocery store where he remained some time. Naturally of a mechanical turn of mind, the business did not seem to have for him the fascination that he at first anticipated. He accordingly made arrangements with a well-known machinist, and entered his shop serving his time of three years. At that time he became interested in the morocco business, and for fifteen years, in one way and another, has been connected in this line. Some time ago he assumed the duties as foreman and engineer at the works of McKendry & Bird. The system there consists of a thirty horse power engine and a fifty horse power boiler.

Mr. Lockney is a Republican, and as an engineer is well known among his associates.

MR. A. G. PERKINS was born in Lancaster, N. H., in 1838. On completing his education, he entered the service of the Boston and Providence Railroad as a fireman. He was connected with this well-known line thirteen years, working up to the position of an engineer. On finishing his work there he came to the world-renowned chocolate manufactory of Walter Baker & Co., where for the long period of fifteen years he has ably been connected. He has made many valuable improvements in his plant, which has been

augmented to a two hundred horse power Putnam engine and six fifty horse power boilers. He is continually studying the best works on steam and kindred subjects, and his plant has acquired an elevated position.

He is a Republican, a Mason, and a prominent Odd Fellow, and as an engineer is most efficient.

MR. C. G. HUDSON was born in Hingham in 1832, where he attended school. He served his time at the Atlantic Works, where he remained six years, being the first apprentice who completed his time at this well-known establishment. On finishing his work there he entered the Navy yard, and for about the same number of years was interested in repairing steam engines. For some time following he was interested in various enterprises, until about a year ago, when he accepted his present position as engineer and machinist at the Lithographic Works of J. H. Bufford's Sons. He has charge of a thirty horse power Armington & Sims engine and a fifty horse power boiler.

Mr. Hudson is a Republican, a Mason, and one of our prominent engineers.

MR. F. A. MANSFIELD was born in Dorchester in 1848. He went to school until about eleven years of age when he began work on the farm. He remained at this vocation seven years and then went to sea, returning two years later, he enlisted in Company H, Sixty-first Regiment of Massachusetts Volunteers. He was in the military nine months, later entering the civil service, remaining three years. At the end of that period he became interested in steam, and finally entered the works of McNeil Bros., the well-known

builders, where for twelve years he has been in successful charge. The plant there consists of a sixty horse power engine and a boiler of the same capacity. Mr. Mansfield is connected with Post 68 of the Grand Army of the Republic, and as an engineer occupies an enviable position.

MR. THOMAS NICHOLS was born in England in 1848, attending the National schools until about thirteen years old, when he was placed with his uncle in the South Wales Iron Works. He there had unusual opportunities for acquiring practical information and definite knowledge of the workings of steam. He remained there until 1871, rising to the position of engineer in chief of a five hundred horse power plant. On coming to America, he was for some time interested in various steam enterprises, and was for eight years connected with the city. Some time ago he assumed charge of the plant at the Eddy refrigerator factory, where he has charge of a twenty-five horse power Allen & Endicott engine and a fifty horse power boiler.

Mr. Nichols is an Odd Fellow, and is prominently known among our engineers.

MR. ALFRED TUTTON was born in England in 1845. He attended the National schools and served his time in his native place, later being connected with some of the largest establishments in the kingdom. On coming to America he was located with several well-known concerns until five years ago, when he assumed charge of the plant at the establishment of Vincent, Hathaway & Co. The system consists of engine, boilers, pumps, etc., and is located on Broad Street. Mr. Tutton is connected with the Sons of St. George, and as an engineer is well and favorably known.

ASSOCIATIONS.

Realizing the importance of frequent intercourse and the necessity for a closer relationship in their work, the engineers of Boston early conceived the idea of organizing societies for the co-mingling of those who desired to avail themselves of the advantages derived from the exchange of thought, and the discussion of matters of mutual interest. The pioneer in the organization of this work may be said to have been Mr. Geo. A. Grover, who, in 1871, agitated the movement among the engineers of the city. He succeeded in drawing about him a few of his fellow laborers, and they organized the first society of its kind under the name of the "Massachusetts Society of Stationary Engineers." They soon had a membership of about a hundred and fifty names, and in the winter of 1872 presented a petition to the Legislature of the Commonwealth, praying that some law be enacted whereby life and property should be protected, by establishing some standard of experience and ability of those in charge of the steam interests of the State.

The petitioners represented about seven million dollars worth of property, but after several hearings the matter was referred to the next General Court. In 1873 this Court took it up and after a lengthy discussion gave the petitioners leave to withdraw. This result, however, did not discourage these resolute men, and the following winter found them

again before the authorities, who, after numerous hearings, reported "inexpedient to legislate."

This was indeed discouraging. Mr. Grover had personally expended much time and money in the movement, and to have his labors thus rewarded was anything but satisfactory. Seeing that the time had not arrived for so progressive an enterprise, he temporarily let the matter rest and gave his attention to the more complete organization of the Association. The little band continued to exist with varying success until 1882. In January of that year Mr. Geo. M. Barker and Mr. R. F. Gerald came to the assistance of Mr. Grover, and the association was thoroughly re-organized and measures taken in regard to a National Convention, to be held in New York City, for the purpose of organizing a "National Society of Stationary Engineers." The date of this convention was set for September 26, and Mr. Barker was elected a delegate, his colleagues from other parts of the country being H. D. Cousins, of Providence, R. I., N. W. Williams, of Philadelphia, Penn., J. H. Baker, of Wilmington, Del., A. M. Davy, of Detroit, Mich., J. G. Beckerleg, of Chicago, Ill., and Mr. Watson, editor of the "Mechanical Engineer," representing the Flour City Association, of Rochester, N. Y. The Association was organized and the following officers elected: President H. D. Cousins; Vice President, G. M. Barker; Secretary, A. M. Davy; Treasurer, J. G. Beckerleg. When fully established the "National Association of Stationary Engineers" began to issue charters on the application of ten responsible and well-known engineers, and the first year chartered about forty subordinate Lodges having a membership of over nineteen hundred.

The second convention was held in Chicago on the first Tuesday in September, 1883, the following officers being

elected : President, J. G. Beckerleg ; Vice President, R. J. Kilpatrick ; Secretary, A. M. Davy ; Treasurer, G. M. Barker. During this year seventeen Lodges were organized augmenting the membership to nearly three thousand names.

The third convention was held at Baltimore, Md., J. G. Beckerleg being elected President ; R. J. Kilpatrick, Vice President ; G. G. Minor, Secretary, and J. M. Barker, Treasurer.

On the first Tuesday of September, 1885, the fourth convention was held in St. Louis, Mo. The following officers were elected : President, R. J. Kilpatrick ; Vice President, N. W. Williams ; Secretary, G. G. Minor, and Treasurer, J. M. Barker. The fifth convention is to be held in Boston, September 7, 1886, and its delegates will undoubtedly represent a total membership of nearly six thousand engineers.

On July 25, 1885, the State Association surrendered its old charter to the National Association, the officers at the time being Geo. A. Grover, President ; Geo. Weir, Vice President ; R. F. Gerald, Secretary ; B. H. Mead, Treasurer, and R. S. Taber, Door-keeper. The following names constitute the committee and organization, appointed by the Massachusetts Association No. 1, Stationary Engineers of Boston, to provide for the reception and entertainment of the delegates to the annual convention of the National Association, to be held in Boston during the week commencing September 7th :—

W. P. Clark, Superintendent Crosby Steam Gauge and Valve Company ; A. F. Upton, Manager Jarvis Engineering Company ; Hamilton A. Hill, of Hill, Clark & Co. ; L. C. Lanphear, of Davidson Steam Pump Company ; B. C. Mudge, of Worthington Steam Pump Company ; George J. Foran, of Deane Steam Pump Company ; S. C. Nightingale,

of Nightingale & Childs ; George H. Barrus, M. E., 81 Milk Street, Boston ; J. F. Burkell, of J. E. Burkell & Co. ; G. A. Grover, 82 Clinton Street, Boston ; R. F. Gerald, with Nightingale & Childs ; F. R. Low, with Boston Journal of Commerce ; H. M. West, engineer Hollins & Co. ; W. A. Matheson, engineer Homœopathic Hospital ; John Post, Jr., of John Post & Co. ; H. M. Swetland, of American Railway Publishing Company ; H. K. Moore, of American Steam Gauge Company, and W. S. Fiske of Knowles and Blake Steam Pump Companies.

ORGANIZATION : R. F. Gerald, Chairman ; H. M. West, Treasurer ; F. R. Low, Secretary.

Sub-Committees : Committee of General Arrangements, G. A. Grover, R. F. Gerald, F. R. Low ; Committee on Finance, W. P. Clark, A. F. Upton, W. S. Fiske, John Post, Jr. ; Committee on Hotels, L. C. Lanphear, G. A. Grover, H. K. Moore, F. R. Low ; Committee on Printing, R. F. Gerald, W. A. Matheson, S. C. Nightingale, G. A. Foran ; Committee to Procure Accommodations from City Government, A. F. Upton, F. R. Low, E. H. Gowing ; Committee to Arrange Excursion to Lawrence, Hamilton A. Hill.

The following is the Constitution of the Association :—

P R E A M B L E .

This Association shall at no time be used for the furtherance of strikes, or in any way interfering between its members and their employers in regard to wages ; recognizing the identity of interests between employer and employé ; not countenancing any project or enterprise that will interfere with the perfect harmony between them ; neither shall it be used for political or religious purposes.

ARTICLE I.

This Association shall be known by the name and title of MASSACHUSETTS ASSOCIATION OF STATIONARY ENGINEERS, No. 1, of Boston.

ARTICLE II.

The object of this Association shall be the elevation and maintenance of the rights of Stationary Engineers, and the recognition of all other business matters in which the engineers in its jurisdiction may be interested or involved ; but no association shall fix a standard of wages for its members.

ARTICLE III.

SECTION 1. This Association shall be composed of Practical Stationary Engineers who are citizens of the United States, of good moral character, and who have practical knowledge of engineering, which shall be determined by an examination and not less than one year's experience.

SEC. 2. This Association cannot be dissolved so long as five members object.

ARTICLE IV.

SEC. 1. This Association shall elect delegates to represent it in a general convention of engineers' associations, for the settlement of all difficulties, and to have only power, in connection with qualified representatives from other associations of like character, to amend, reconstruct, or repeal any article of this Constitution.

ARTICLE V.

SEC. 1. All subordinate associations shall pay with each quarterly report, in advance, per capita tax of five cents for each member on their books.

ARTICLE VI.

OFFICERS AND THEIR DUTIES.

SEC. 1. The officers of this Association shall consist of President, Vice-President, Treasurer, Financial Secretary, Corresponding Secretary, Conductor, Doorkeeper, and three Trustees.

SEC. 2. The election of officers shall be at the last regular meeting in June of each year, and they shall be installed at the first regular meeting in July.

SEC. 3. The President shall, on the eve of the installation of officers, appoint such standing committees as may be provided by the By-Laws; and of all other committees he shall appoint the majority and the Vice-President the minority.

SEC. 4. In the absence of the President, the Vice-President shall take the chair, and appoint a Vice-President *pro tem*. Should both be absent, then the Secretary shall call the meeting to order, and elect a President *pro tem*.

SEC. 5. It shall be the duty of the President to preside at all meetings of the Association, preserve order, enforce articles of the Constitution and By-Laws, watch faithfully over the interests and affairs of the Association. He shall be assisted by all the officers. He shall decide all questions of order; he shall have power to call meetings whenever he deems it necessary, or is requested by five or more members, and perform such other duties as the Association may request. The President may call the Vice-President to the chair, when he wishes to discuss any question.

SEC. 6. It shall be the duty of the Vice-President to aid the President in the discharge of his duties. He shall preside in his absence, and perform all duties devolving upon the President, which the Association may require.

SEC. 7. The Recording Secretary shall keep the records of all minutes of the Association, and shall have his books ready at all times for inspection, as the Association may direct by the Trustees.

SEC. 8. The Treasurer shall receive from the Financial Secretary all moneys collected by him, pay all orders directed by the Association to be drawn on him, signed by the President and Recording Secretary. He shall keep a correct account of all moneys received and paid out by him, and have his books open for examination at such times as the Association may direct by the Trustees.

SEC. 9. It shall be the duty of the Financial Secretary to keep a true account between the Association and its members, receive all initiation fees, dues, fines, and assessments, and pay the same over to the Treasurer. He shall notify all delinquents who may be in arrears for dues, fines, and assessments, and have his books open for examination at such times as the Association may direct by the Trustees.

SEC. 10. The Corresponding Secretary shall carry on all correspondence, answer all communications, issue all summons and notices required, and serve them; also, read all communications before the Association. His official letters must bear the seal of the Association.

SEC. 11. The duties of the Conductor will be to introduce all candidates and render assistance to the President when required, take charge of all paraphernalia pertaining to the secret work.

SEC. 12. The Doorkeeper shall have charge of the door.

SEC. 13. The Past-President shall receive and introduce all visiting brothers, and install officers in the absence of the Deputy.

SEC. 14. The Trustees shall have a general supervision of the property of the Association, and shall make all contracts

for hiring and renting of the hall, collect all moneys for the same, paying it over to the Treasurer, taking his receipt therefor. They shall also hire a janitor when necessary, at a reasonable compensation for his labor. They shall also, when deemed necessary in their judgment for the comfort and benefit of the Association, recommend, in writing, to the Association the purchase or sale of such property as they see fit; said recommendation to be indorsed by the full Board of Trustees. They shall at all times act under the direction of the Association.

ARTICLE VII.

VACANCIES IN OFFICE.

SEC. 1. Should any vacancy occur in any office, by death, resignation, or other cause, the Association will proceed to elect a successor, to serve the remainder of the unexpired term.

SEC. 2. It shall be the duty of the President to appoint local Secretaries in each subordinate association, where no mutual aid exists.

ARTICLE VIII.

MEMBERSHIP.

SEC. 1. Any person desiring to become a member of this Subordinate Association shall make written application through any member of the Association, or the Recording Secretary; said application shall be referred to a committee, who shall inquire into his moral character and qualifications as a Stationary Engineer; said committee to report at the next regular meeting of the Association, when, if the report be favorable, a ballot shall be taken; and, if not more than three black balls appear against the candidate, he shall be

declared elected. If a candidate is rejected, he cannot be balloted for again for the space of six months, and is not eligible to membership in any association without the consent of the association where rejected. At the time of proposing a candidate, the proposer shall pay such a sum as the By-Laws shall specify. In any case, should the candidate be rejected, the fees shall be returned to the proposer, and by him to the person rejected; and all other associations in the vicinity shall be notified of his rejection.

SEC. 2. Every proposition for membership must be made one week before being balloted for, and all associations in that city notified; and, before the ballot is cast, the President shall request the members to state such knowledge as they may have of the candidate's character and qualification, and whether there is any serious objection to his becoming a member.

SEC. 3. Each subordinate body shall be judge of the qualifications of its members, subject to the National Constitution.

SEC. 4. All persons desiring to join this Association must go before a board composed of members of this Order, and be examined as to their qualifications as Stationary Engineers, before they can be admitted to membership.

ARTICLE IX.

HONORARY MEMBERS.

SEC. 1. Each subordinate association may provide for honorary or contributing members, to be elected from citizens who desire to aid us in our object, and may allow them all the privileges of full members, except voting and acting as representatives.

ARTICLE X.

INITIATION FEE.

SEC. 1. The Initiation Fee to be paid by candidates joining subordinate associations shall not be less than \$3.

ARTICLE XI.

DUES AND ASSESSMENTS.

SEC. 1. Each subordinate association shall have power to regulate its own dues, assessments, and penalties.

SEC. 2. The Association shall have power to assess its members for extraordinary purposes, but not to exceed the sum of \$5, and shall not levy a fine to exceed \$5.

ARTICLE XII.

SEC. 1. This Association will not authorize the issue of any certificate, badge, or other evidence of membership, except a pass or travelling card, which shall never be issued for more than three months, and no such card shall be issued if the applicant shall be in arrears for dues. In cases where necessary, by a majority vote of the Association, the time may be extended, not to exceed twelve months, applicant in all cases pre-paying his dues for the time said card is in force.

ARTICLE XIII.

FUNDS.

SEC. 1. Any subordinate association disbanding shall transmit to the Secretary of the National Association all moneys, books, papers, seals, and charters; and, in the event of reorganizing the association, it shall be entitled to receive back the same by payment of the usual charter fee.

SEC. 2. No charter shall be granted for the re-organizing of a disbanded association, unless the application be signed by twelve applicants.

SEC. 3. Each association shall make an annual statistical and financial report in addition to its regular quarterly report at the end of each fiscal year, said report to be forwarded to the Secretary of the National Association, and shall be made out upon blank forms furnished for that purpose.

SEC. 4. Any subordinate association failing to make an annual report of its condition to the National Association for each year shall have its charter annulled.

SEC. 5. Withdrawal cards, properly issued, shall be evidence of the fitness of any member to join any subordinate association ; but such cards shall be deposited with an association within twelve months from the date of the issue.

ARTICLE XIV.

PENALTIES.

SEC. 1. Any member who shall in any way violate any of the principles of the Association, or offend against any article or section of this Constitution, By-Laws, or Rules of Order, shall be fined, expelled, or suspended, as the By-Laws or Constitution provide, or the Association may determine.

SEC. 2. Complaints must be made in writing and handed to the President, and by him to a special committee. The committee shall investigate the complaint, and, if sufficient grounds for a charge be found, the committee shall report to the Association forthwith, together with the charge ; and, if the charge or charges are sustained, the accused will then abide by the decision of the Association.

SEC. 3. Every member of this Association shall hold himself in duty bound to recognize every other member's

good standing as a brother, and shall not traduce or slander his character or willfully or maliciously injure him in any way, on penalty of being suspended or expelled from the Association.

SEC. 4. Intoxication shall be considered a sufficient cause for expulsion. If any subordinate association should deem it necessary to expel a member for the violation of its Constitution or By-Laws, he shall remain expelled for all time to come, unless the said subordinate association shall be granted permission by the Board of Arbitrators to reinstate him by stating his cause of expulsion.

ARTICLE XV.

Robert's Manual shall decide all questions in the debate or proceedings of this body.

ARTICLE XVI.

BY-LAWS.

SEC. 1. Each subordinate association may enact such By-Laws as may be deemed necessary for its local work, provided, however, they are in accordance with National and Subordinate Constitution.

SEC. 2. Each subordinate association may amend or repeal any By-Law by a two-thirds vote. But such amendment must lie over one week before final action can be taken thereon.

INDEPENDENT ORDER OF STATIONARY ENGINEERS.—On April 26, 1884, this Order was organized with the following officers :—

Chief, S. C. Spaulding ; Assistant Chief, E. H. Wilson ;

Recording Secretary, Edward King ; Finance Secretary, J. P. Allen ; Treasurer, D. W. Cook ; Marshall, W. J. Ray.

The following taken from the Constitution and By-Laws of this organization will perhaps best illustrate its aim :—

The necessity for united action in works of charity and friendship is demonstrated by the general practice of mankind. In every department of benevolent enterprise the agency of organized societies is resorted to for the purpose of advancing more rapidly and effectually the welfare of the human race.

Much good may be produced, much evil may be averted, in the transitory scenes of human existence, by the associated actions and sympathies of masses of men. What is society itself but a community of individuals organized, upon certain general principles, for mutual interest and protection? What are the laws and constitution of a country but a prescribed rule of conduct for its inhabitants, intended to preserve their personal rights, and protect them in the enjoyment of the proceeds of their industry and enterprise? Without such an organization there could be no security of life, liberty, or property. The weak, the peaceful, and the honest would become the prey of the strong, the warlike, and the corrupt. There would be no government but that of force, no justice but revenge, no law but licentiousness. But there are many evils which the laws and usages of society do not attempt to alleviate. Therefore we organize with a view to promote the best interests of Engineers ; to assist the steam users to procure competent, reliable help ; to elevate the calling, and assist the unemployed to get work. We are, therefore, desirous that all competent engineers should become members, and unite with us in our work. We propose to render material aid in sickness and adversity, and, when the "Great Chief" above shall call,

pay the sad tribute of respect due all worthy men and brothers.

AMERICAN SOCIETY OF STEAM-ENGINEERS.—Illustrative of the aims of the organization, we make the following extract from an article quite recently published in "*Power with which is incorporated Steam.*"

This society was organized March 22d, 1881, with the following officers: Milton G. Wood, chief engineer, Post Office, Boston, President; John H. Grueby, chief engineer, City Hall, Boston, Vice President; John H. Blanchard, chief engineer, American House, Boston, Treasurer; Wm. H. Bailey, Boston, Secretary. These gentlemen, with Geo. E. Stafford, chief engineer, State House, Boston; Wm. V. Warfield, chief engineer, Rogers estate, Boston; Wm. E. Burrows, chief engineer, Ashcroft Manufacturing Company, Boston; Chas. E. Jacks, chief engineer, Steam and Power Company, Boston, and Albert H. Stone, assistant engineer, Post Office Building, Boston, constitute the board of directors.

The society has opened an office at 186 Washington Street, which is being nicely fitted up and is always open to its members and others interested in steam appliances.

The main features of the society are:

1. It is not a secret society, but is conducted on the basis of club-room gatherings with the doors open for the admission of competent and intelligent engineers.

2. The certificates of membership are in three grades. To the engineer capable of taking the complete management of a large steam plant, understanding fully the philosophy and manipulation of steam, the first-class certificate is issued. To those whose experience has not carried them so

far in the science of steam engineering, but who are thoroughly practical and capable men, the second-class certificates are given. And to those entering the profession and whose experience entitles them to recognition as engineers, while their experience is not such as to warrant their taking charge of the management of larger plants, the third-class certificates are given.

These grades are entirely for the benefit of the engineers, and those employing them, as they are intended to show the employer at once, the grade of ability of the man who offers himself as an applicant for the management of his steam apparatus. And they form an incentive to study and promotion among the engineers, as any one holding the second or third-class certificate, can at any time apply for a re-examination, and if his qualification entitles him to receive a better grade certificate, it will be at once issued by the society.

Another object of the society is the insurance of its members. Every member of the society is asked to pay one dollar to the society at the death of any other member. The society in turn pay this money over to the relatives of the deceased member, so that it offers a cheap basis of moderate insurance.

The members of the society may join without taking the insurance feature, if they so desire, and simply become members of the society, holding the graded certificates, and be entirely exempt from all assessments.

The society proposes, as fast as possible, to appoint agents and a board of inspectors in all the large places, who will represent the organization in their vicinity.

No annual dues or assessments are required from the subordinate organizations to maintain the offices of the society, and after a man has once become a member, this certificate

is good as long as he lives, unless it be revoked for immorality or some other just cause.

When legislation requires each engineer to hold some sort of a certificate before he is entrusted with the lives and property of his fellowmen, those already having passed an examination of this kind and holding certificates from this organization, will have taken the first step towards fulfilling the requirements of the law.

The objects of the society are further set forth by their circular from which we note the following points :—

“A record is kept of the references, testimonials, and examiner's report of each member, so that whenever an engineer is wanted for any particular position the secretary can refer to his books and find one having the exact experience and qualifications required, thereby saving employers much time and trouble, and enabling engineers to obtain just the situations they are most competent to fill.

“Provision is also made in the by-laws of the society for evening lessons in the practical use of the condenser, indicator, planimeter, dynamometer, and other scientific instruction by which engineers of the second and third class may qualify for higher grades, and those of the first class may learn what they may be deficient in. It is the intention of the directors to introduce other features of interest and benefit to members as their numbers and funds will warrant them in doing so.”

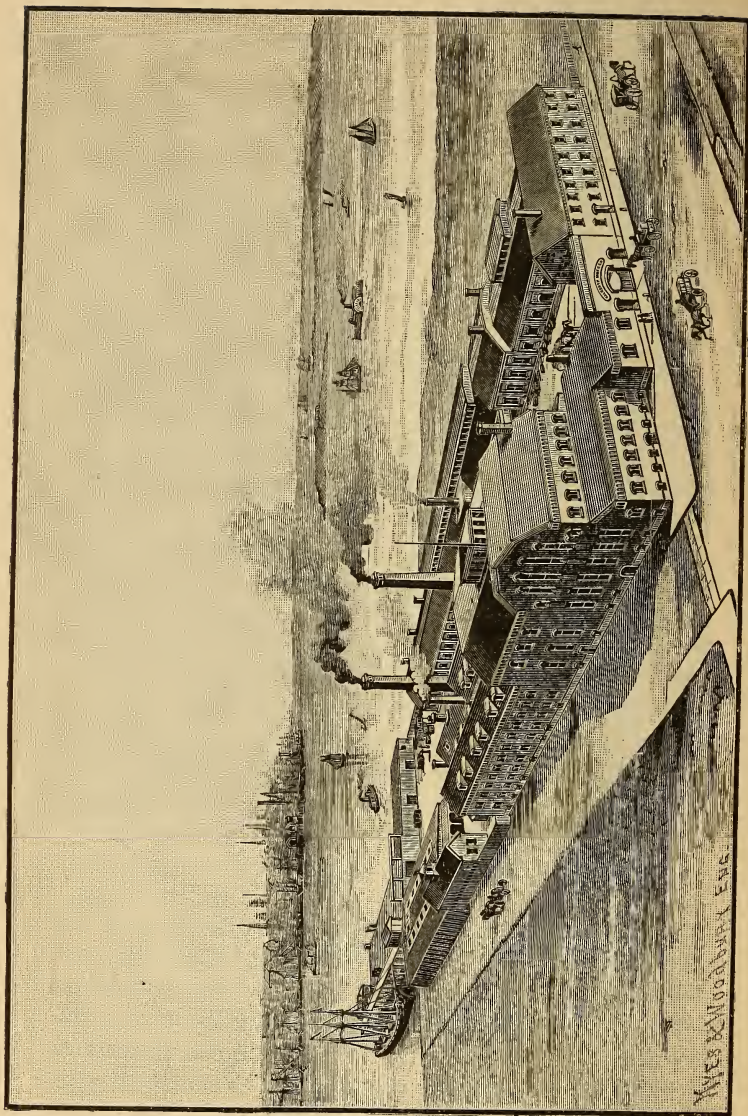
From the large number of first class engineers that have already joined the society and from the letters of commendation received by the secretary from steam users, the promoters feel that they have hit upon the right plan to meet the wants of both engineers and employers, and that their organization will be a permanent institution of great benefit to all concerned.

MANUFACTURERS.

In the preceding pages we have followed the history of steam in a general way to the present time. We have become somewhat familiar with the steam plants of the city, and have cultivated the acquaintance of our leading engineers. Nevertheless, were we to draw our work to a close here it would be incomplete indeed.

While the discoverers of a principle and those who have the care of intricate systems are important factors in the improved plants of today, their efforts would be in vain to a greater or less degree were it not for those who have given their attention to the manufacture of the appliances which have conduced to the steam interests of the city as they are today. As the following reviews of representative houses are designed to illustrate the growth and enterprise of the manufacture of steam appliances, we trust these pages will prove interesting and profitable.

THE WALWORTH MANUFACTURING COMPANY, now the leading house in the United States in the manufacture and construction of steam-heating apparatus, was founded in 1842 by James J. Walworth, now the president of the company, and Joseph Nason, his brother-in-law, and commenced business under the firm name of Walworth & Nason at 18 Devonshire Street, Boston, and 36 Ann Street, New York.



WALWORTH MANUFACTURING CO. ENG.

WORKS OF THE WALWORTH MANUFACTURING COMPANY.

Previous to that date Mr. Nason had travelled abroad and become familiar with the Perkins hot-water apparatus, then in use in England, and at about that time gas-works were being introduced into American cities, creating a demand for gas-pipe. Steam-heating apparatus with small pipe, as now universally used, was unknown.

The new firm was started for the purpose of selling gas and water pipe, gas-fittings and hot-water apparatus. Up to this time all wrought-iron pipe was imported from England in a few small sizes only, and kept for sale in some hardware stores in assorted lengths, a man having to pick out a piece of the length he wanted, or else file it off and get a thread cut in a lathe. About this time, a demand having arisen from construction of gas works, Morris & Tasker began to make wrought-iron pipe in a small way at Philadelphia, and afterwards at Moymensing, Pa. Fittings were imported from England, where they were forged by hand from wrought iron.

About 1844, Mr. Walworth and Mr. Nason began to use wrought-iron pipe as small as one and three-fourths inch, for steam-heating apparatus. The art was in embryo : there were no dates, precedents or appliances ; but Mr. Nason was a good mechanic and a man of great ingenuity as well as good judgment, and it is a remarkable fact that almost all the expedients used and appliances invented by him are substantially in use today, though modified in detail ; in this category may be mentioned, among many others, the cylindrical horizontal multitubular boiler, the globe-float, the float steam trap, and the vertical tube radiator.

Among the earliest buildings fitted with steam-heating apparatus were the Eastern Exchange Hotel, the Burlington Woolen Mills, Slater's Cotton Mills, the Amoskeag Com-

pany's Mill, and Fletcher & Co's. Cotton Mill (Providence).

The first public building warmed by steam was the Boston Custom House, for which the contract was signed Jan. 8, 1849. In this building a fan blower, in combination with indirect radiation, was first used; this apparatus remained in use until a few years ago when it was superseded by a more modern one. The Revere House, Tremont House, and Winthrop House were early instances of the application of steam to warming and cooking in hotels by Walworth & Nason, while some of the hot-water apparatus placed by them in private houses remains in use to this day.

As this firm was the first in the business, it educated a large number of men who afterwards became heads of concerns themselves, or otherwise well known in the business. Among these may be mentioned Mr. Braman and Mr. Perham of Braman & Perham, now Braman, Dow & Co., Mr. Kendricken, of Ingalls & Kendricken, Mr. Robert Briggs, afterwards superintendent for Morris, Tasker & Morris, Mr. Bundy the inventor of the Bundy Radiator, J. C. Chapman, the inventor of the Chapman Valve, D. C. Stillson, the inventor of the universally used Stillson Wrench, and Mr. Franklin of A. B. Franklin & Co.

In 1853 the old firm was divided, Mr. Nason taking the New York branch, now the Nason Manufacturing Company, while Mr. J. J. Walworth associated with himself, in Boston, his brother Mr. C. C. Walworth (now vice president and general manager) under the firm name of J. J. Walworth & Co. This firm was reorganized as a Massachusetts corporation in 1872.

Mr. C. C. Walworth has had entire charge of the mechanical part of the business, and has contributed to its success by a large number of valuable inventions. Among these may be named the Walworth Radiator, the Manifold

Tee, an improved die-plate, a pipe cutter, an automatic sprinkler and many improvements in rapid tapping machinery. He still retains as general manager, the active supervision of all the branches of a very extended and complicated business.

The place of business of this company remained at 18 Devonshire Street until 1869, when it was removed to 1 Bath Street. This building stood on the present location of Post Office Square, and was destroyed with all its contents in the great Boston fire of 1872. The next place of business after a temporary lodgement in Haymarket Square, was at 69 Kilby Street, whence the company removed in 1883 to its present location at 16 Oliver Street.

The workshop of the company was originally its cellar in Devonshire Street. When this place was outgrown quarters were obtained in Blake's Court, and soon after in Allen & Endicott's establishment at Cambridgeport. There the works grew until they absorbed very nearly the whole premises and still were cramped for room. In 1881 a desirable piece of property was purchased at City Point (the old Crystal Glass Works) consisting of ten acres of upland and adjoining marsh. The old buildings were remodeled and new ones built including a foundry four hundred and twenty-five feet long, and an entirely new plant of motive power, much new and improved machinery being put in, giving occupation to some four hundred men and adding new life to that part of the city. These works, which are said by experts to be the best equipped in this country, of their kind, consist of a four-story machine shop, a pattern shop, iron foundry, brass foundry, forge shop, store houses, radiator shop, stable for twenty-five horses, sand and coal sheds, and a fine granite wharf.

Of course, great changes have been made in the con-

struction of heating apparatus during the existence of this house. The earliest apparatus built by them was the Perkins hot-water apparatus, made of coils of three-fourths inch pipe, and built to stand three hundred pounds pressure per square inch ; the thorough manner in which these were constructed is attested by the fact that some of them are in operation today : one example may be seen in the house of Mr. E. C. Milliken, No. 15 Ashburton Place, which was put in in 1844, forty-two years ago. The first *steam* apparatus consisted of parallel lines of pipe, three-fourths inch, secured to the walls very much as it is often arranged in mills today ; for rooms or offices the pipes were shortened and multiplied in number and called "box-coils," and were often concealed by ornamental screens and marble slabs, steam being used at high pressure. A good example of this apparatus may be seen in use at the Bay State House, Worcester, about twenty-five years old. This style of apparatus was apt to be noisy unless very carefully handled, but this defect has been obviated by the use of lower pressure of steam with larger pipes, and the invention of radiators as substitutes for box-coils. It was also found that the condensed water could be made to return to the boiler by gravity, instead of being pumped back, by simply making the supply pipes large enough to maintain an equilibrium of pressure throughout the whole apparatus ; low pressure hot-water apparatus has also been substituted for high pressure with the best results and no other apparatus is found to be so well adapted to our most luxurious residences.

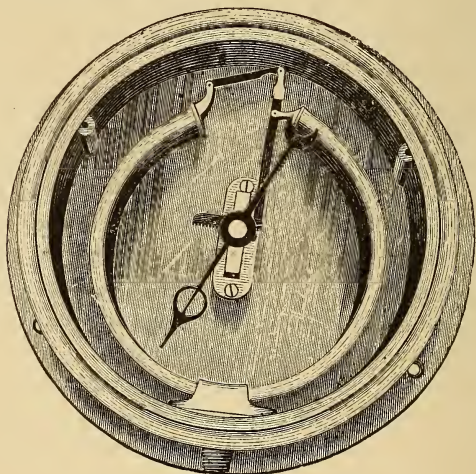
THE WALWORTH MANUFACTURING COMPANY'S contract for the first apparatus at Custom House amounted to \$6,750. Since that time they have constructed some of the largest apparatus in the world, the contract for the apparatus at Columbus, Ohio, Insane Asylum being over \$120,000.

Among the largest buildings in this country warmed by them may be mentioned the State Capitols of Michigan, Iowa, and Indiana, the Boston Post Office, and the new Pension Office at Washington. The apparatus in the National Capitol was constructed by Mr. Nason after his separation from the Boston house. Among the famous hotels equipped complete by them may be named the "Windsor," New York, the "United States," Saratoga, the "Brunswick," Boston, and the "Pequot House," New London; while their latest work in this city is the new apparatus of the New England Conservatory of Music. Besides steam apparatus, the construction of gasoline gas-machines and regulators, has occupied an important department of this company, and a very large number of their machines are in use all over the United States, both in seashore hotels and private residences.

The latest enterprise undertaken by the WALWORTH MANUFACTURING COMPANY is the construction of automatic fire extinguishing apparatus, using an ingenious and effective sprinkler invented by Messrs. C. C. Walworth and O. B. Hall. Not less than one hundred thousand of these "heads" with the accompanying system of water-pipes have been placed in mills and factories already, and the demand for their use is constantly increasing, and is extending to other classes of buildings.

In addition to the domestic business described above, this company is rapidly developing a foreign trade, their tools being found so superior as to displace much cheaper ones made abroad. They are now sending to England, Germany and Denmark malleable gas-fittings, die plates, wrenches, cutters, and a general assortment of steam-fitters' tools.

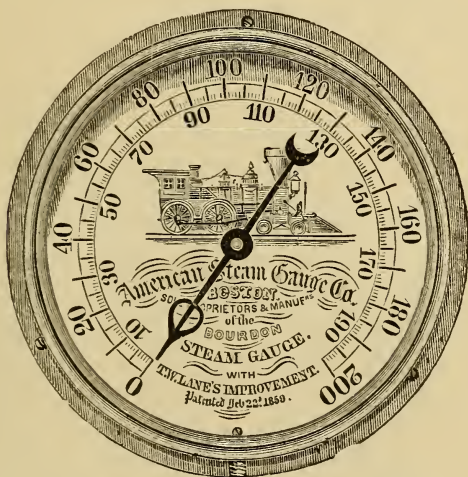
PROBABLY the oldest concern in its line is the AMERICAN STEAM GAUGE COMPANY, whose business was established in 1851, they being incorporated in 1854. They are, in fact, the original Steam Gauge Company and the sole manufacturers of the Bourdon Steam Gauge with Lane's improvement, Thompson's and Richard's Steam-Engine Indicators, Amsler's Polar Planimeter, The Pantograph, Hussey's Speed Indicator, Haley's Shut-off Nozzle, American Pop Safety Valves ; also, Water Gauges, Gauge Cocks, Whistles, Revolution Counters, Seth Thomas and Howard Clocks, Pyrometers, Hydrometers, Salinometers, Spring Balances, Mercurial Siphon Gauges, Low-Water and Alarm Gauges, and all kinds of Steamship Instruments.



LANE'S IMPROVED DOUBLE-SPRING GAUGE.

They have always endeavored to produce an article that would meet all the requirements of their customers at a moderate cost. They have ever been painstaking, ready to

cheerfully give useful information or do anything within the bounds of reason that would accommodate those who, in buying goods in their line, gave them the preference. It is a noteworthy fact that when they discover that any article purchased from them does not give entire satisfaction, they make haste to rectify it.



ENGRAVED LOCOMOTIVE GAUGE.

They are the original manufacturers of Double Bourdon Tube Spring Steam Gauges, as their patents will show. The patent under which they manufacture these Double-Spring Steam Gauges is the well-known "Lane Improvement," patent dated Feb. 22, 1859, extended Feb. 22, 1873.

The Lane Improvement removes all the objectional features of the Bourdon Gauge, in preventing vibration of the hand, and in preventing freezing up the spring in case of exposure.

The rack and pinion are made of hardened steel. *The brazed tube, wherever used in competition with the seamless, has proven its superiority in points of durability and accuracy.*

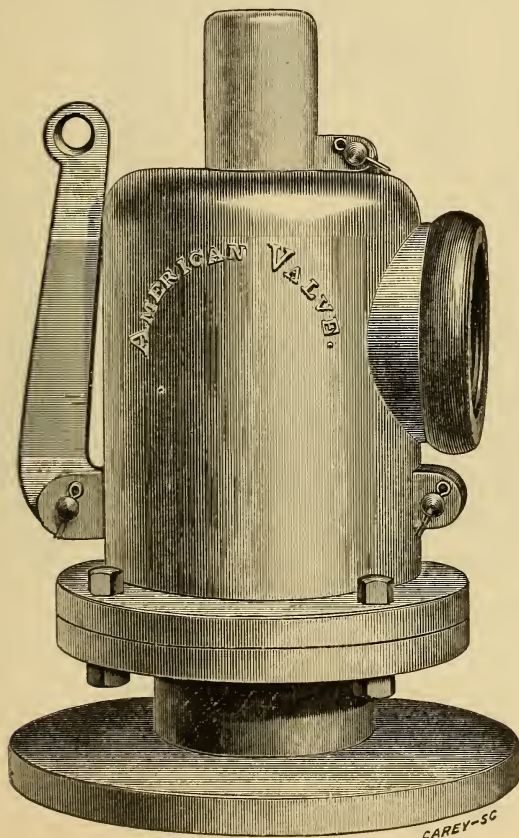
A safety valve is, in every sense of the word, a sure preventive against boiler explosions from excessive pressure.

The inadequacy of the common lever safety valve has long since been recognized, and the only positive safety valve that can be used must be automatic and positive in action.

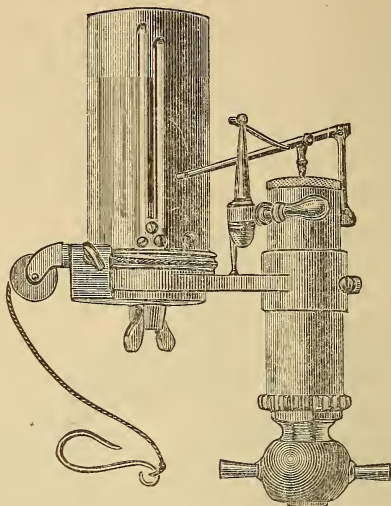
The American Pop Safety Valve complies with all the requirements of a true safety valve, and has been approved by the United States Board of Supervising Inspectors, and placed in the highest grade of pop safety valves by that board.

The American Pop Safety Valve is the only double-headed safety valve being provided with a second or movable head on the top of the valve proper. There are two series of holes drilled around the outer edge of these heads for the purpose of reducing the amount of increased area; the first of the series being around the head of the valve proper, and drilled at an angle of ninety degrees with the seat of the same; the second series being around the second or movable head, and drilled at an angle of fifty-five degrees with the holes in the head of the valve proper. Now, the movable head is placed in such a position upon the head of the valve proper, that there is a small opening between the holes in the head of the valve proper and in the corresponding holes in the second or movable head. Now, it will be readily seen that the result of this device is simply this,—that, when the valve lifts from the seat to blow, the passage of the steam through the holes in the head of the valve proper passes into the corresponding holes in the

second or movable head ; and, as the walls of the holes in the movable head are at an angle of fifty-five degrees with the holes in the head of the valve proper, the second or movable head will be forced around in such a manner that the holes in the two heads will be directly in line with each other, the result being a decrease of increased area.



AMERICAN POP SAFETY VALVE.



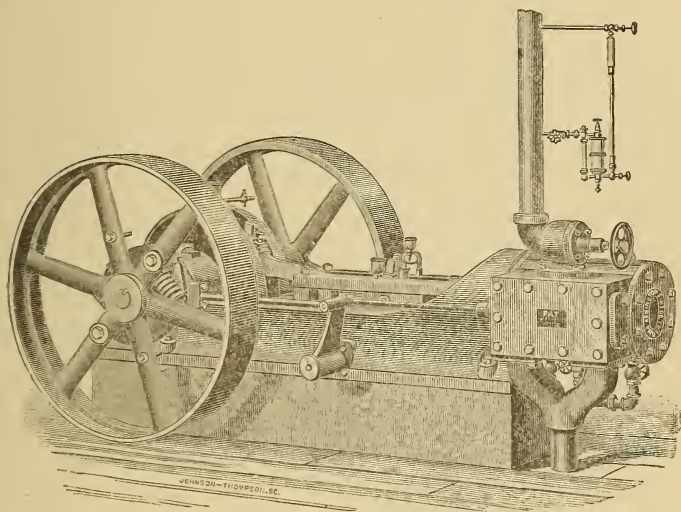
THOMPSON'S IMPROVED INDICATOR.

The office of the Company is located at No. 36 Chardon Street, where they have a factory fitted with the most approved appliances for the construction of their valuable devices. The officers are J. G. Blaisdell, President; E. Burt. Philips, Treasurer; and H. K. Moore, Superintendent. The latter gentleman having been connected with the Company for the long period of thirty-five years, giving his undivided attention to the constant improvements which have continually been introduced.

The grand result of his labors is amply demonstrated by the popularity of the appliances of the American Steam Gauge Company among the engineers of the country.

Each of the other gentlemen are too well and favorably known to require any remarks in their connection. Their management has given to the Company an admirable standing among the great houses of America.

THE JARVIS ENGINEERING COMPANY.—In these times of great improvements when there are so many and varied kinds and characters of steam and other appliances, it is indeed a great advantage to those about to construct large systems, that there is an engineering company which is prepared to contract for steam plants, complete for electric lighting stations including engine, boiler, furnaces, feed-waters, heaters, boiler-feed-pumps, injectors, belting, valves,



THE ARMINGTON & SIMS ENGINE.—IMPROVED DOUBLE DISK STYLE.

pipe-work, fire-brick and mason work, etc., delivered and erected complete ready for use, together with the services of competent men to start and run the same for a limited time. Their experience in this class of work, as well as in the erection of motive power for manufacturing establishments, amply demonstrate the fact that they can give satisfaction in every particular.

They submit estimates and plans on receipt of the necessary data, and are always pleased to receive communications from parties interested in the subject of electric lighting.

Making a specialty of equipping electric light stations, they have given great attention to the various engines in the market, and the result has been to confirm their opinion that no engine has met with such success or achieved such general popularity in this field as the Armington & Sims.

Out of some nineteen hundred engines built or in process of construction, up to the present writing, by far the larger portion of them are driving dynamos.

The advantages of this engine may be briefly stated as follows: extreme simplicity; the entire absence of parts requiring frequent adjustment; great regularity of speed; small cost, especially for the greater powers; small space required for engine and fly wheels; a compact form, and consequent rigidity in moving and stationary parts, unattainable in engines of long stroke; the employment of short and nearly parallel belts in place of long, converging ones; the avoidance of intermediate gearing, to produce the speed required; great saving in room, building and foundations.

It connects by direct belting to the dynamos, doing away with all lines of shafting. One wheel can be used for generating electric power while the other can be used for electric lighting at the same time, or the two driving wheels can be used for two systems of electric lighting as arc and incandescent.

Particular attention is given to the construction of the Armington & Sims Engine; to its simplicity; the large bearings; solidity of the bed; perfection of the workmanship; the quality of the materials used.

The Automatic Cut-Off Regulator is original in every respect; it is perfect in its operations. All its parts can be

readily reached, and are always in sight. It is attached directly to the valve-rod, and varies the point of cut-off as the resistance requires, from the commencement to sevenths of the stroke without changing the lead—a feature peculiar to this regulator. It acts instantaneously, and whatever the change in load or pressure of steam, the speed remains constant. The total variation in speed, from an extreme light load to the capacity of the engine, will not exceed two per cent.

The Valve which is an important factor in the economy of this engine, is perfectly balanced, and surrounded at all times by live steam. By its unique construction it permits the full steam pressure to be maintained in the cylinder up to the point of cut-off.

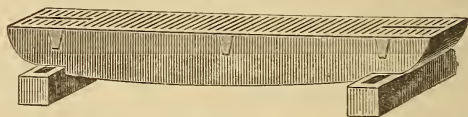
No pains have been spared to make this the leading engine as regards economy of fuel, workmanship, simplicity, durability and moderate prices.

They have also interested themselves extensively in boiler setting and are the inventors and sole owners of the Jarvis Patent Furnace for setting steam boilers, which has proved such a valuable invention.

In spite of its great importance, no part of a steam plant is usually given as little care and attention as the boiler furnace. This is wrong; for, especially in electric lighting, the coal thrown under the boilers must always be one of the largest items of expense, and managers of electric lighting business cannot afford to overlook the fact that they are virtually selling power, and power cheaply produced goes a long way towards dividends. Years of constant service have shown the Jarvis Furnace to be one of the best means in existence of securing the largest returns for the money invested in fuel.

The principal features of the furnace consist in the setting,

whereby air is admitted by small flues in the front and then conducted through a number of horizontal expanding ducts, through which it passes backward and forward until finally, in a heated state, it enters at the bridge wall and sides of the furnace in jets through fire-brick plates, uniting with the products of combustion and causing consumption of the gases.



The great economy of the Jarvis furnace over the common setting, is that it will burn all kinds of cheap fuel without the use of a blower ; that is, Anthracite coal screenings (with a small mixture of bituminous), bituminous slack coal, pea coal, wet hops, wet sawdust, logwood chips, rice chaff, bagasse from sugar cane, coke, coke breeze, etc.



It is well known that perfect combustion of fuel does not take place until the gases are fully generated. To get this with cheap grades of fuel, requires about forty per cent. of moisture, to generate *hydrogen*, and utilize the gas with hot air (oxygen), this giving a *hydro-oxygen* or compound blow-pipe flame.

The improvements introduced in this furnace consist in a peculiar way of setting the brick-work, which is built on the principle that what the fire needs in addition to air through the grate, is pure hot air discharged on top of the fire to mix with the gases generated on the grate.

As there are now over 3,000 boilers set with this furnace, and as it has stood the test of time, being in use in nearly every state in the Union, burning all sorts of fuels under all sorts of conditions, it is no longer an "experiment," but is acknowledged as an unquestioned success.

Among the many advantages of the Jarvis Patent Furnace as applied to boilers are : increased steam capacity ; large reduction or prevention of smoke ; durability of boilers ; saving of fuel, using ordinary grates ; reduction of fuel bills by the use of the *cheaper* grades of fuel, such as slack, coal dust, etc. This last item is most important in dollars and cents, as it has been shown repeatedly that a bushel of slack coal burned in the Jarvis gives practically as good results as a bushel of high-priced lump coal in the common setting. The difference in cost of the quantity used gives the net saving, which can be calculated by any one.

They are also interested in the well-known National Rocking Grate Bar and the Sheffield Grate Bar, which have now been in use for many years under severe and continuous duty. It has fully demonstrated its superiority over other grates in the points of durability and economy of fuel.

They recommend the National Feed Water Heater, which is one of the recent improvements in steam appliances that is becoming extremely popular, and consider the Korting Universal Double Tube Injector a great success.

In connection with their work of constructing steam plants, they have made a study of the different qualities of fire brick and fire clays, and all their goods are stamped with their name, and the quality is guaranteed to be the best in the market.

They have equipped many of the largest plants of the country, and to-day the Jarvis Engineering Company stand unrivaled in their line of work.

It will hardly be disputed that the manufacture of a superior valve is among the most important connected with a steam plant.

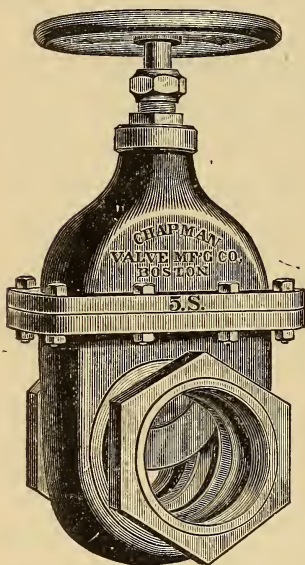
The primitive steam valve, though a crude idea, served the purpose for which it was intended up to about ten years ago. At that time the improvement in nearly every department of mechanics had become something largely in

advance of anything ever heretofore known, and the old valve was far from satisfactorily meeting the demands continually made upon it by the new and improved appliances.

However, necessity is indeed the mother of invention, and the result was the introduction of the Chapman Valve, so well known today throughout the country. Though starting under the adverse circumstances of "hard times," and a thoroughly equipped list of competitors of the old appliances in the valve and hydrant business, this company

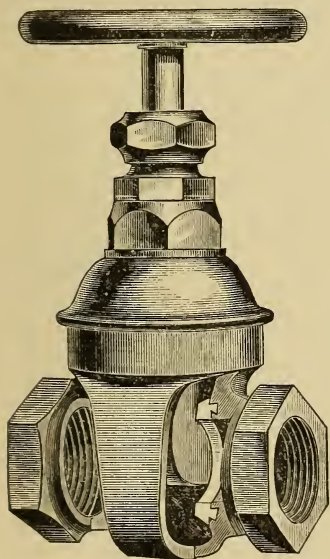
believed that the Chapman, if honestly built, was in the end sure to win the favor of the public in its general principles of construction and adaptability for all general uses to which a straight-way valve or fire hydrant may be applied.

The verdict of the public after these ten years, without solicitation of trade on their part to any extent, has obliged them, in order to meet the demand of the trade, to enlarge from time to time, until now they have the largest and



best equipped works in the country for the manufacture of these goods. They have combined in the construction of their appliances simplicity of action and superior material, and employing the most skilled workmen have succeeded in producing the best at a fair cost.

The Chapman gate valve has a clear passage, the full diameter of the connecting pipe, and this may be called its



characteristic feature. In details, the valve varies considerably, according to the service to which it is to be put and the pressure which is to be brought upon the gate. Of the numerous special forms manufactured by the company, we select a number which are more particularly adapted to the use of builders. The valve gate or plug is cast in one piece, and is made hollow and tapering. It is prevented from coming into contact with the seats until closed by splines cast on the body, which engage

grooves in the side of the gate, and thus retain it always in the center of the opening. The splines are made of unequal thickness, in order to prevent the plug from being inserted improperly in case of its removal for repairs or otherwise. The gate has double faces, and is equally tight on both sides. It rises and falls on the spindle in the preferred form, but, when desired the plug is made to move with the spindle. The composition of the spindles, all of which are made of

extra diameter to avoid twisting, depends upon the fluid with which they come in contact.

For steam or water, gun metal composition is generally used, while for ammonia or gas, steel or iron is preferred. Where the valve is to be subjected to strong pressure, the parts

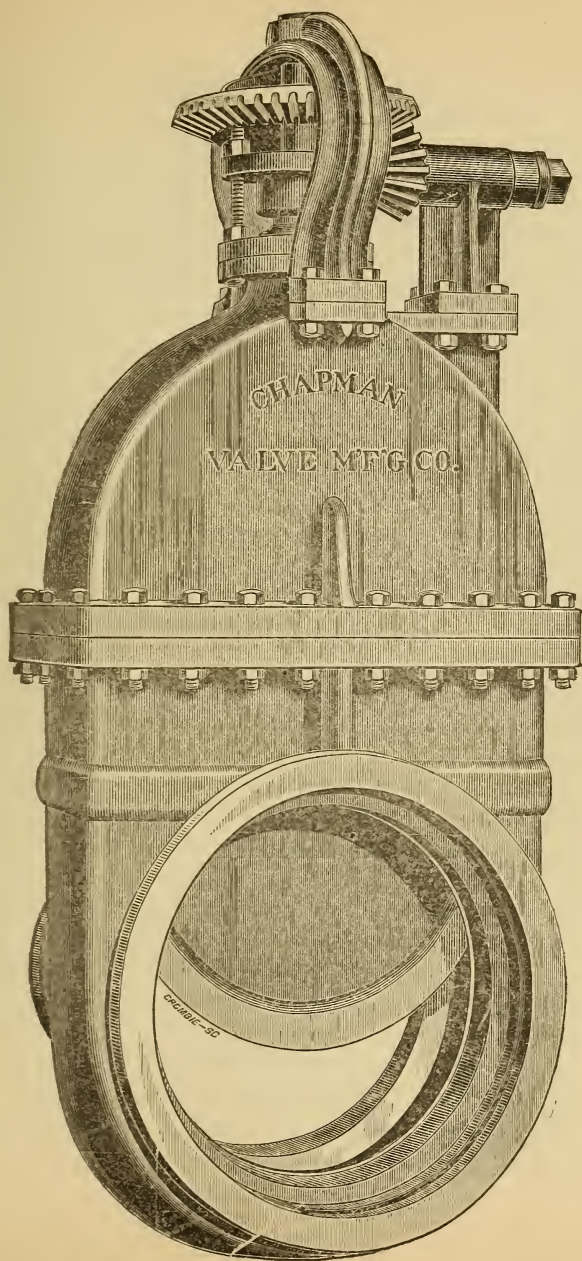


are made unusually heavy. The seats are composed of an alloy similar to Babbitt metal, but vary with the nature of the fluids acting upon them. Their composition is decided by the material which experience has demonstrated to be the most resistant to corrosion. The seats are held to the body by means of dovetailed grooves, and are formed upon the plug itself, producing an exact counterpart of the faces of the plug on both sides, thus making a perfectly fitting joint, which, by the construction of the valve, wears tighter in use, and always preserves its bearings.

Both the plug and seat being non-corrosive, the valve works with ease, even after having been closed for years.

An automatic drip valve, as shown has been devised for cases where it is necessary to drain the water from a pipe after the supply has been cut off by closing the main valve. This obviates the need of an extra drain valve, which is apt to be troublesome, in addition to its expense.

The iron body valve, with outside screw and yoke, has been devised to meet the demand for a valve in which, from its frequent use, it is desirable to have the screw where it can be readily cleaned and oiled. Particular attention has been



given to the details of the fire hydrant. In opening, the gate rises upon the spindle into a recess below the hydrant pipe, large enough to admit the full passage of water from the main, and closes vertically, gradually cutting off the flow of water and preventing any water hammer or strain upon the pipe. A drip outlet is also provided on a level with the water in the main, and is opened and closed automatically by the action of the gate. As the drip outlet is always open when the gate is closed, there is no liability of freezing. Great care has been taken to make the operation of the hydrant perfectly sure and reliable.

The officers of the company are : S. P. Payson, President ; Percival L. Everett, Treasurer ; and Jason Giles, General Manager. Their office is at 72 Kilby Street, Boston, Mass.

It will hardly be disputed that to no other department of manufacture is attached so grave responsibility as to that of elevator building. A machine that is never put in motion except to lift or lower human beings or property should be safe, beyond all doubt or question, and no one would knowingly buy or use an elevator falling short of this standard.

In dealing with the problem how best to attain and maintain such a standard of excellence, OTIS BROS. & Co. have followed two cardinal principles : first, to make such machine, with its car or platform and their connections, intrinsically safe, independently of any special safety devices ; and, second, to add to the apparatus, so built, such devices, adapted to the particular kind of service, as would best control and regulate its operation, prevent undue speed, and guard against any conceivable accident or result of carelessness in operation, or negligence in the care of the elevator.

In the case of their Standard Hydraulic Passenger Elevators, which are now generally employed for the best class of passenger elevator service, and which are certainly carrying more passengers than any other type of elevator in the world, they so build each machine that its power is absolutely exhausted the moment the car reaches its upper or lower landing. The car must therefore securely stop at one or the other of these points, independently of the action of any safety device, independently of the operator, and whether the hand-rope or other means of regulating the movement of the machine from the car be in perfect order, or broken or destroyed while the car is in motion.

Each machine is connected with the car by two solid piston-rods, and at least four wire cables, any one of which is capable of sustaining a weight largely in excess of the maximum load to be lifted by the elevator.

In addition to providing the simplest and best forms of appliances for starting and stopping this elevator, they place under each car their safety platform, to which every lifting cable is independently attached, and to this platform is also connected, by a wire cable, their independent safety governor. In case of the undue stretching and breakage of any lifting cable, or should the car, from any cause, attain a degree of speed beyond the rate fixed by the governor, the safety apparatus brings the car, gradually but unfailingly, to a full stop, and securely holds it at or near the point in the shaft where such apparatus is brought into action.

They confidently claim for this elevator, that it is by far the safest which has ever been built, and they are able to say that, of the countless millions of passengers who have been carried by their passenger elevators (both hydraulic and steam), not a single one has suffered loss of life or limb from any accident to any such elevators, during the

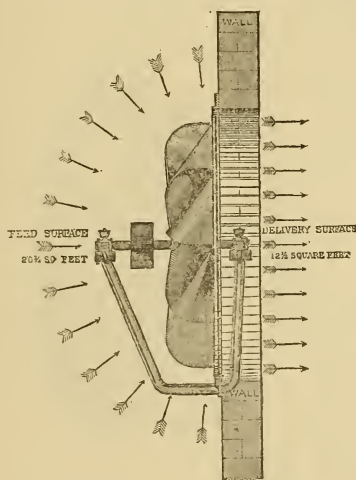
entire period of thirty-four years which they have devoted to elevator manufacture.

They are well aware that their methods of manufacture, whereby many parts are duplicated and reduplicated beyond any probable requirements of duty which the elevator is built to perform, involve an amount of expenditure that largely increases the first cost of their elevators, as compared with those of different and cheaper construction, but, having thus far followed the theory that the elevator is peculiarly a machine demanding a higher factor of safety than any other, and the security of which should not only be real, but also so apparent as to command the confidence of every user, and their methods having been vindicated, not alone by general recognition of the superiority of their machines in every part of the world where elevators are used, but also by an amount of business that has increased to vast proportions, they feel fully justified in continuing to rely upon the approval and patronage of those who appreciate the value of established merits, and demonstrated security in elevator service.

The Boston office of the company is located at 70 Kilby Street, MR. H. A. JOSLIN representing them in New England.

NEW YORK EXHAUST VENTILATING COMPANY.—The problem of moving air in great volumes and at the same time subjecting it to mechanical control, is one which has long commanded the thoughtful attention of scientific men. In mills, factories, engine rooms, boiler rooms and public buildings where large numbers of persons congregate, there has been, heretofore, absolutely no method of securing uniform ventilation.

Appliances for moving air in *limited quantities* by means of power, have been in use to a small extent during the past few years, but until the invention and perfection of the Blackman Wheel no scientific system was known or possible for moving large volumes of either hot or cold air at pleasure, distributing it under absolute mechanical [control to suit the varying conditions of different places ac-



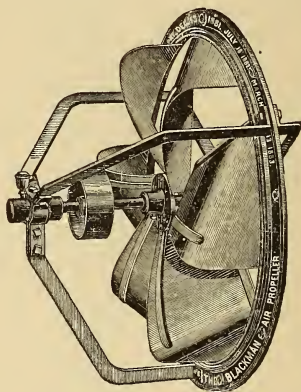
cording to their different uses and regardless of location, size or character of the building to be ventilated.

The device by which they accomplish the movement of great bodies of air is known as the Blackman Ventilating Wheel or Air Propeller. The various modes of applying this power so as to obtain the desired results and their knowledge of these methods and their application, entitle them to claim for themselves a scientific system.

The feature which distinguishes this wheel from all

ordinary fans is the construction of its blades. The curvature of the blade at its periphery forms a sort of end bucket.

This peculiar form of blade prevents all radial escape of air and causes a direct inward flow all over the large area here created. A glance at the illustration will render plain the above description and will verify their assertion that this wheel possesses a feed area greater than that of any flat or straight blade fan by more than sixty per cent.



The Blackman Wheel is the only exhaust or blast wheel (or fan) known which takes in air at right angles as well as parallel with its axis or shaft.

This united volume of air being concentrated within the folds of the periphery, or end bucket, is driven with increased force from the exit side of the wheel. Hence they get large volume combined with greater economy of power.

That this increased efficiency in peripheral power is recognized everywhere as novel, distinctive and positive is proven by the fact that patents have been issued upon

it by nearly all (20) governments. Were it possible to have shown a prior use of this form of wheel no patents would have been granted.

It is remarkable that so simple a contrivance for moving air in enormous volumes, combined with suction or pressure, should not have been discovered years ago, but it remained for the Blackman Wheel to reveal the feasibility of perfect ventilation under complete control.

Besides the usual ventilation of halls, schools, theatres, hospitals, churches, working rooms and all other places occupied by numbers of persons, this wheel has proved invaluable in numerous branches of business, such as paper mills, woolen and cotton mills, blacksmith shops, sugar refineries, laundries, hotels or restaurants, carpet cleaners, soap makers, brewers and malsters and many other manufactories, where it is desirable to remove dust, foul air, fumes of acids, smoke, steam, etc., etc., or to create powerful currents of air for drying and similar purposes.

At 370 revolutions per minute a Blackman Wheel (48 inches in diameter) will remove 30,000 cubic feet of air per minute with about one and eight-tenths horse power; that is to say, about 1,000,000 cubic feet per hour, per horse power. It will be readily admitted that they are entitled to claim for this wheel the maximum of volume and the minimum of power.

In order to ensure the best results it is their custom to select the location in each place where a wheel is to be used. They are prepared to furnish drawings on short notice and to set up their wheels under contract, covering all work incidental thereto, or to sell the wheels with instructions as to setting up.

The New England office of the company is at No. 32 Oliver Street, Mr. J. E. Sayles being the agent.

PROBABLY no manufacturing company is better or more favorably known in its special work than the EXETER MACHINE WORKS.

One of their most successful appliances is the Exeter Engine.

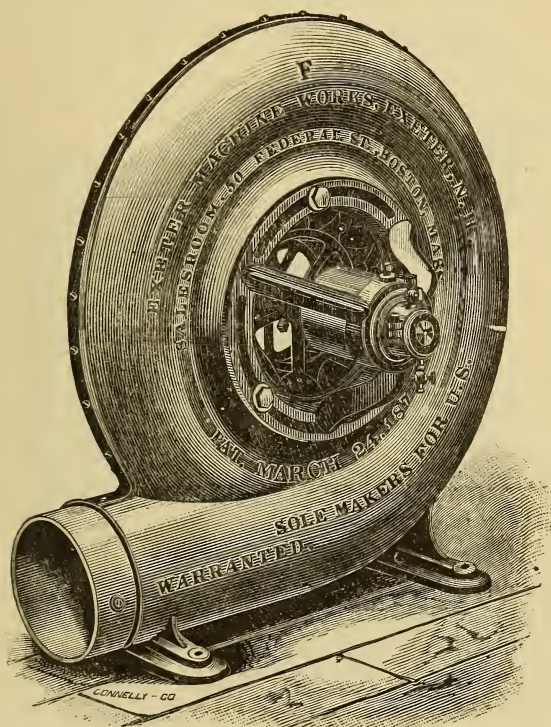
This engine, as built, represents the result of many years of energetic endeavor on the part of the builders to place on the market, at a reasonable price, as perfect a slide-valve engine as skill, steadfastness and good material could produce, and they have so far succeeded, that with those who have used them, and are consequently able to judge, no engine is more popular.

As distinctive features of construction in this engine we mention the cast iron base, or bed, which admits of the engine being set firmly on brick work; the connection of cast iron between the main engine and bearing, which confines the parts of greatest strain in such manner as to insure their rigidity, and contains the slides in one piece; and the great strength and symmetry of all castings. The moving and wearing are well attended to. The piston and valve rods, the crank and wrist pins are of steel, the shafts are forged of best iron, and all boxes and bearings are lined with best babbitt. The governor furnished is the "Waters," with "stop motion." There is also furnished with each engine, foundation bolts, wrenches and a full set oil cups of approved pattern.

Provided with few parts, no great skill is required to successfully run it, and liability to accident is reduced to a minimum by these few parts being well and strongly built. Its durability and economy are attested to by its years of success, and as a representative of its class it has but few equals and no superiors.

A specialty of the Exeter Machine Works is the manu-

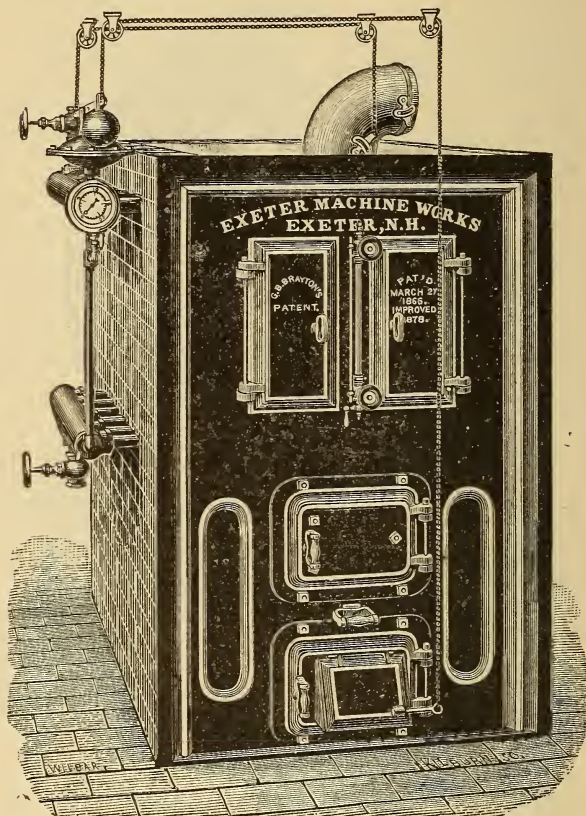
facture of blowers, and they are made in various styles and for all purposes. Pressure blowers, fan blowers and exhaust fans, also double exhausts.



Pressure blowers, are used principally where a strong blast is required, and the one built by this company is a very strong machine and will give a pressure equal to sixteen ounces to the square inch.

The fan wheel of this machine, while it is strongly built, is very light running, so that an extra amount of power is not consumed in running it.

Fan blowers are used where a large amount of air is re-



quired instead of pressure, and are used for supplying air for ventilation purposes, also for blowing fires under boilers and forges, and in connection with heating pipes for heating

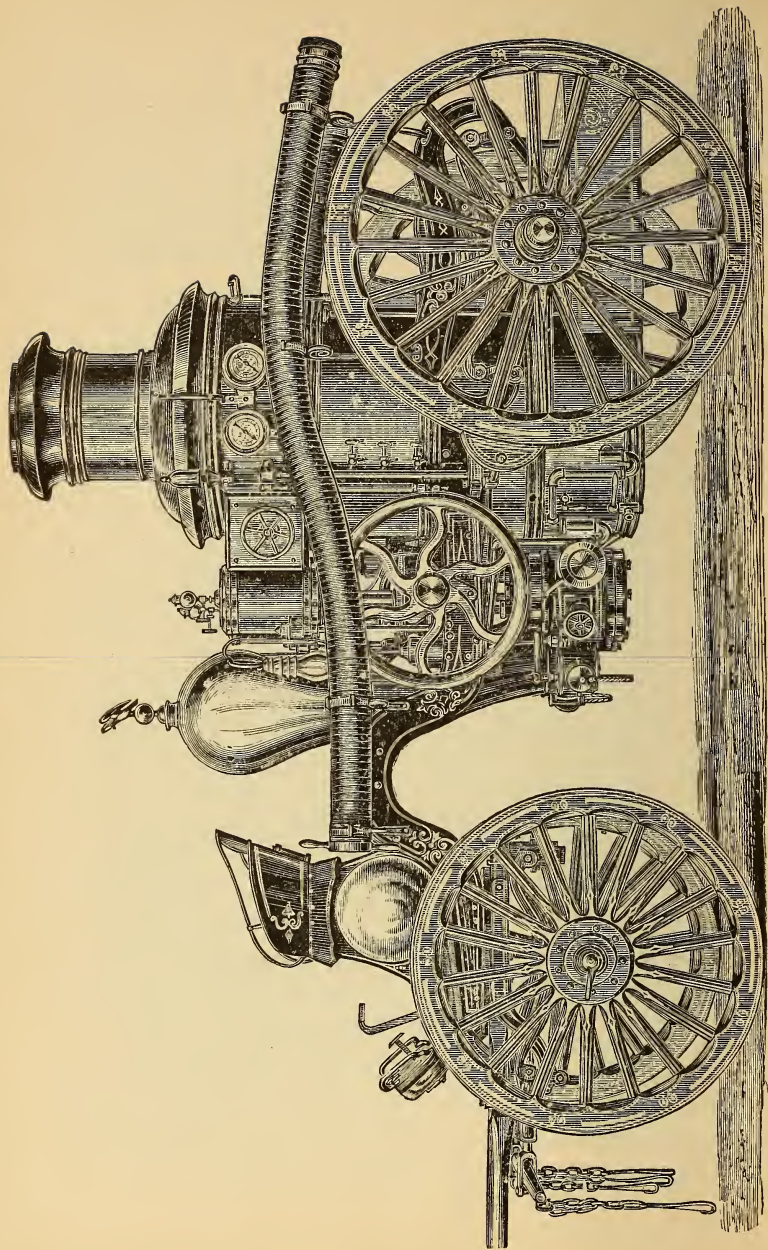
public buildings, hospitals, churches and halls ; also for dry rooms and kilns for drying lumber, wool, leather, boards, etc.

Exhaust fans are used for removing smoke, gas and foul air from boiler rooms, mines and all places where a pure atmosphere is desirable.

A special pattern of exhausters for removing shavings and saw dust from planing and saw mills is made with rims of wrought iron or steel, which is considered an improvement over the old style on account of the ease with which it can be taken down for repairs.

Each of these styles of machines are fitted with self-oiling boxes which make them peculiarly adapted for high speed and hard work.

It is now, and always has been, the aim of the Exeter Machine Works to keep ahead of all competitors in the manufacture of a safe, economical and durable steam-heating apparatus for private residences. It needs years of experience to meet all the requirements of a first-class heating apparatus placed in charge of inexperienced attendants. Eight years ago their apparatus was considered first-class. They have made various improvements from time to time, as experience and use suggested, and they are always ready to adopt any real improvements, even with increased cost to apparatus. The first requirement is absolute safety, even with the grossest carelessness. They are willing to allow their boiler to stand the most severe test in this respect. Durability, ease of management, and economy, have all been carefully looked after. They do not propose to quietly sell their apparatus on its past record, but are now manufacturing under three patents granted within the past two years ; and although this apparatus may not be the cheapest in the market, it is furnished at as low a figure as the combination of all the enumerated good qualities will admit.



AMOSKEAG FIRE ENGINE.

MANCHESTER LOCOMOTIVE WORKS.—The record of the “Amoskeag” Steam Fire Engines built at Manchester, N. H., first by the Amoskeag Manufacturing Company, latterly, and at present by the Manchester Locomotive Works, is remarkable for the great success and popularity they have attained from the start. Among the pioneers the “Amoskeag” has steadily advanced in favor and splendid achievement, and today has no equal for strength, durability, beauty of workmanship and far-throwing powers.

The boiler used is upright and tubular in style, very simple in its construction, and for safely, strength, accessibility for repairs, and capacity for generating steam is unsurpassed. The connections with the steam cylinders are simple, may be easily placed and replaced when necessary for repairs, and have the great advantage of being entirely unexposed to the air. The pump is a double acting and vertical piston one, and for effectiveness and reliability is unsurpassed. It is arranged for receiving the suction hose on either side, and has its outlets also on either side for receiving the leading hose. The hose draft engines are made with crane necked frames, and are mounted on platform springs. On their arrangement of springs they have obtained a patent. The effect of this improvement is that the draft strain is transmitted directly from the horses to the axles, the springs bearing no part of this strain as is usually the case. The material used in the construction of these engines and their workmanship are of the best quality, and the Manchester Locomotive Works guarantee to replace at their own expense such parts, if any, as may fail within a year, if such failure is properly attributable to defective material or inferior workmanship.

Among the largest purchasers of Amoskeag Steam Fire Engines may be named the United States Government 33,

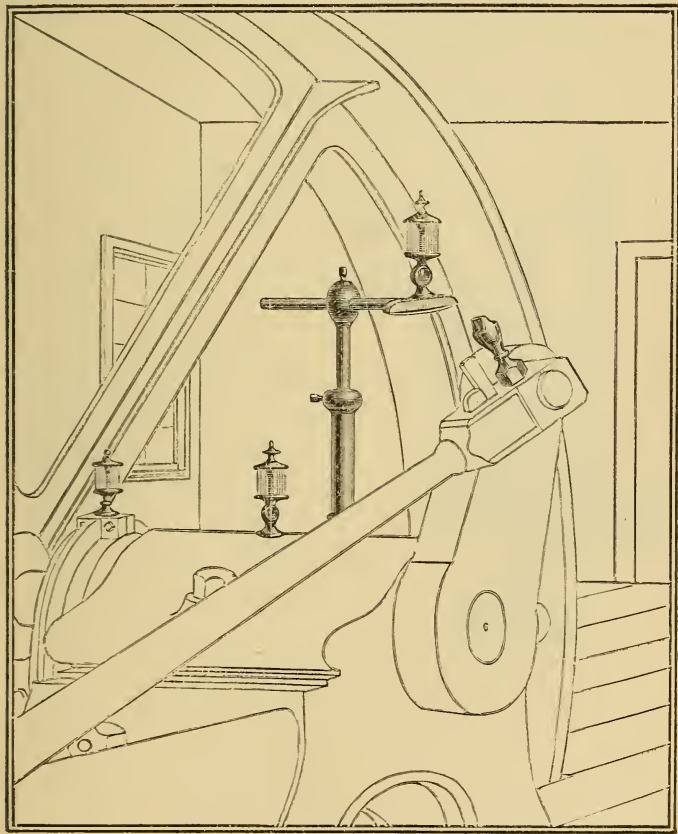
New York City 55, Boston 23, Brooklyn 23, New Orleans 18, Philadelphia 17, Chicago 17, Pittsburg, Pa., 17, also one or more Amoskeags may be found in every city and town of importance in the country. These engines are made in all sizes from the fourth size single pump, hand draft, throwing 350 gallons per minute, up to the magnificent extra first size, throwing 1100 gallons per minute. Recently beautiful photographs of a first size Amoskeag Steam Fire Engine were presented to the leading chief engineers of the country, and in the margin of each picture is printed these words: "This steam fire engine was exhibited at the convention of the New York State Firemen's Association at Syracuse, N. Y., August 11, 12, 13, and 14, 1885, and at a public trial there, threw horizontal streams through smooth-bore nozzles, as follows: 1 1-4 inch nozzle, 334 feet; 1 1-2 inch nozzle, 334 feet; 1 3-8 inch nozzle, 329 feet; 1 5-8 inch nozzle, 316 feet; two streams, 1 1-8 inch nozzles, 296 feet."

This record we believe has never been excelled. The officers of the Manchester Locomotive Works are John A. Burnham, President, 40 Water Street, Boston, Aretas Blood, Agent at the works, Manchester, N. H., and William G. Means, Treasurer, 40 Water Street, Boston.

ONE of the most popular concerns in the city is the "SEIBERT CYLINDER OIL CUP COMPANY," manufacturers of lubricators for stationary and marine engines, pumps, Automatic Crank Pin Oilers and Visible Feed Oil Cups.

It has been their constant endeavor since the formation of the company in 1878, to manufacture in the principle involved as well as workmanship, the best sight-feed lubricating device for all kinds of steam cylinders. They have recently obtained control of a number of patents of different

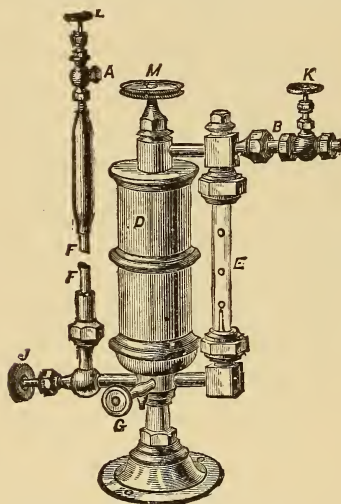
devices for oiling or lubricating the bearing surfaces of engines, some of which they have already perfected and offer to the trade.



CAREY-EE

At this late day, when their stationary engine cups have been in use for the past fifteen years, with thousands of

them in every part of the country, it seems scarcely necessary to say anything about the advantages of their system of lubrication, as it must be clear to all engineers that by the use of their oil cups with the patent sight-feed, a large amount of friction and consequent wear is avoided, as the oil is regularly fed, drop by drop, into the steam and carried to all the internal parts of the engine, while the saving of twenty-five to fifty per cent. of oil by this method of lubrication is an undisputed fact.



Understanding the demand for means of a lubricating crank and cross-head pins continuously and regularly, and considering the Wilkinson patent device, as combined with a visible feed oil cup, the most perfect arrangement now in use. They have recently obtained control of an interest in the Wilkinson patent, and with some slight improvements

they now offer the automatic crank-pin oiler to the trade.

In lubricating all bearing surfaces the minimum of wear and of oil required to properly lubricate is reached by a regular and constant feed. The Wilkinson Crank-Pin Oiler consists of an oil-cup attached to an adjustable supporting frame, which holds the cup stationary over the centre of the bearing to be lubricated. Suspended beneath the oil-cup is a web of fibrous material upon which the oil is fed; being seen as it drops from the cup to the web it can be regulated

as desired. Upon the crank connection and in the hole where an ordinary crank-pin cup would be placed, is a wiper cup, so called, being a cup-shaped tube for conducting the oil to the bearing surfaces, provided with a metallic blade for wiping or scraping the oil from the suspended web, the oil-cup and web being so adjusted that the wiper cup removes the oil from the web at each revolution of the engine.

The office of the company is at No. 53 Oliver Street, and their success is deservedly due to the improved appliances which they have perfected and been instrumental in introducing.

ANOTHER valuable adjunct to a steam plant is the Peerless Damper Regulator, which has been in practical use for the past five years in several hundred of the largest manufacturing concerns of New England. It regulates the supply of air passing through the furnace, increasing or diminishing the draught sooner than the indications would prompt the fireman to act. It prevents the gases passing off unconsumed, controls the steam pressure, insures safety from explosion, and maintains an even degree of heat, thereby preventing undue expansion and contraction of the boilers, preserving the grate bars and saving the cost of repairs.

It allows only the requisite quantity of air to be admitted that is required to unite with the carbon and the gaseous products developed in the process of combustion in order to insure the greatest degree of heat from every pound of fuel.

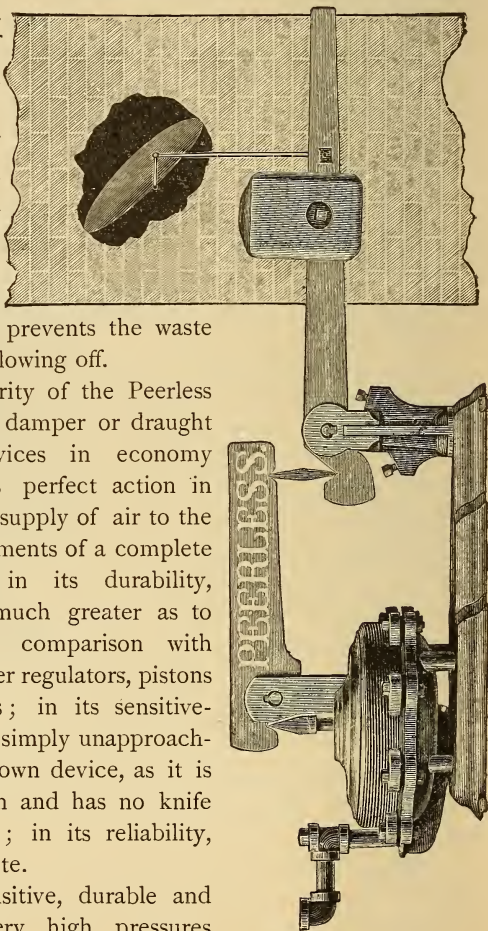
It varies the quantity of air admitted to the furnace at different times to meet the varying conditions of the fuel in process of combustion, and thus at all times produces that

perfect union of oxygen with the products of combustion necessary to economy,

It gives an absolute and perfect control of the fire, affording as great a guarantee of safety from over pressure as any safety valve, and in connection therewith affords absolute security from explosion, and prevents the waste of steam by blowing off.

The superiority of the Peerless over all other damper or draught regulating devices in economy consists in its perfect action in regulating the supply of air to the proper requirements of a complete combustion; in its durability, which is so much greater as to preclude any comparison with ordinary damper regulators, pistons or attachments; in its sensitiveness, which is simply unapproachable by any known device, as it is without friction and has no knife edges to wear; in its reliability, which is absolute.

It is as sensitive, durable and reliable at very high pressures



as at low pressures, a quality which no other machine possesses.

Its immense superiority is proved by its past record of five years of practical usage with its sensitiveness unimpaired and its economic value established.

It is manufactured by the AMERICAN APPLIANCE COMPANY, at No. 62 Sudbury Street.

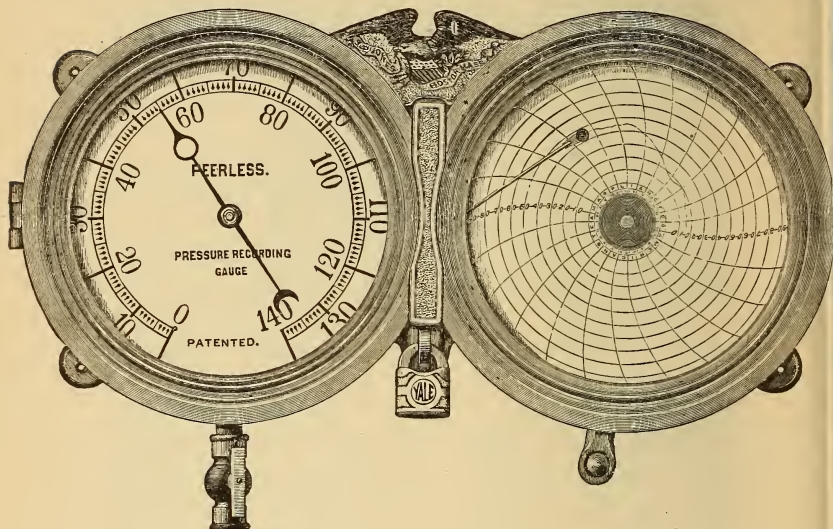
ONE of the wonderful inventions of the age is the Peerless Pressure Recording Gauge.

Its construction is that of the ordinary Bourdon Pressure Gauge which operates a swinging lever turning on a pivot ; the end of the lever carries a pencil which rises and falls with the variations of pressure, causing the pencil to make a continuous mark upon the dial which is revolved by clock work once in twenty-four hours. The dial indicates the pressure by the concentric circles which correspond with the pressure marks, as shown on the pressure or indicating dial, and are so numbered ; while the time is shown by the radial lines which represent the distance the dial turns each hour and have the hours marked upon them around the centre and on the outside as shown on dial.

The lever which carries the marker is attached direct to the steam gauge mechanism in the simplest manner, consequently there is nothing to get out of order, and the marker must rise and fall with the pressure absolutely and with the utmost sensitiveness.

The recording dial is a disc of paper and revolves continually by means of the clock work, consequently the pencil will make a continuous mark, rising and falling with the changes of pressure, thus indicating every variation, the exact time they occur, and their duration. The Peerless Gauge

will run over three days with one winding, thus avoiding the necessity of winding on Sundays, which must be done with other makes. The Peerless Gauge is a practical gauge made



for service and is as easily put up as an ordinary steam gauge, and is in every respect as durable and reliable.

This device is manufactured by MR. S. B. JONES, the sole manufacturer, his office being located at No. 28 School Street.

PROBABLY no appliance has received more attention from practical engineers than the "Baragwanath Brass Tube Exhaust Steam Jacket, Feed Water, Boiler and Purifier." It boils water by exhaust steam, and is adapted for either high or low pressure engines.

The steam jacket heater is a non-radiator, delivering its feed water as hot as the exhaust steam, which is almost invariably several degrees above boiling. That portion of the water chamber inside shell, which in an ordinary heater is subject to the cooling action of the atmosphere is converted into heating surface.

It always delivers its water at or above the boiling point. It purifies the water, keeps the boiler clean, and will not become clogged up if properly blown off. It is the strongest heater made, and the safest under high pressure. It avoids the necessity of pumping hot water. It is simple in construction and requires no care other than to be properly blown off. It never causes any back pressure, but, acting as a surface condenser, always reduces any back pressure that may exist. It saves boiler repairs and increases their steaming capacity. Experience in placing more than three thousand feed water boilers has shown that the average saving of fuel is approximately as follows :

Taking water at 33° F., from 20 to 40 per cent.

"	"	140° F.,	"	15 to 20	"
"	"	175° F.,	"	10 to 15	"
"	"	200° F.,	"	5 to 10	"

From a test recently made at Reed's Block, Boston, by Mr. E. E. Odell, the saving in coal, by delivering feed water at 216 degrees F., was found to be over eight per cent over feeding water at 200 degrees F., the cost of coal being as follows, per diem :

Water at 200° F.,	.	.	.	.	\$12.79
" 216° F.,	.	.	.	.	11 77
Amount saved,	.	.	.	.	\$1.02
or 8 6-10 %.					

In calculating the saving to be effected by one of their feed-water boilers, it is necessary to consider not only the

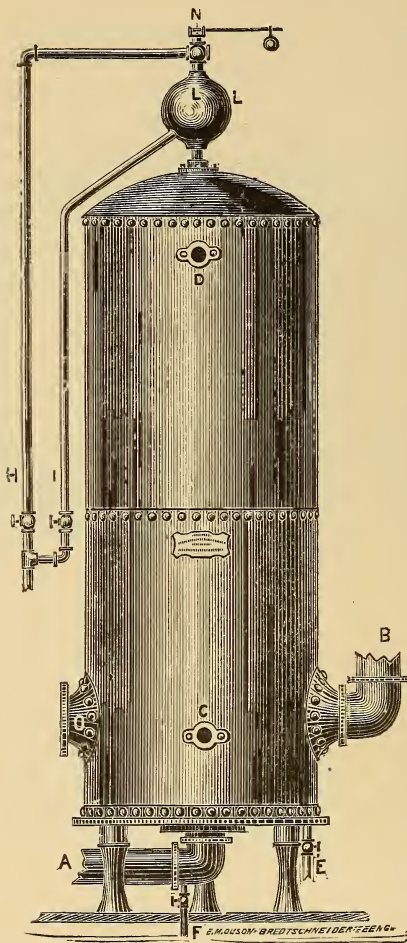


FIG. A.

body, WW its head, and JJJ tubes running from one head to the other. SS represents the jacket; PP an annular space between water chamber and jacket. The exhaust

saving arising from the increase in temperature of the water, but also from the greater efficiency of clean boilers. Another item in the saving is the reduction of back pressure on the engine which they have frequently found to be several pounds.

Where boilers have been forced, the increased steaming capacity resulting from the use of their boiler and purifier, permits of much lighter firing, and consequently better combustion and economy in fuel.

Figure A, elevation of boiler. Figure B, vertical section. The apparatus is a cylindrical vessel, and consists of two parts, the boiler proper or water chamber and its case. RR represents the

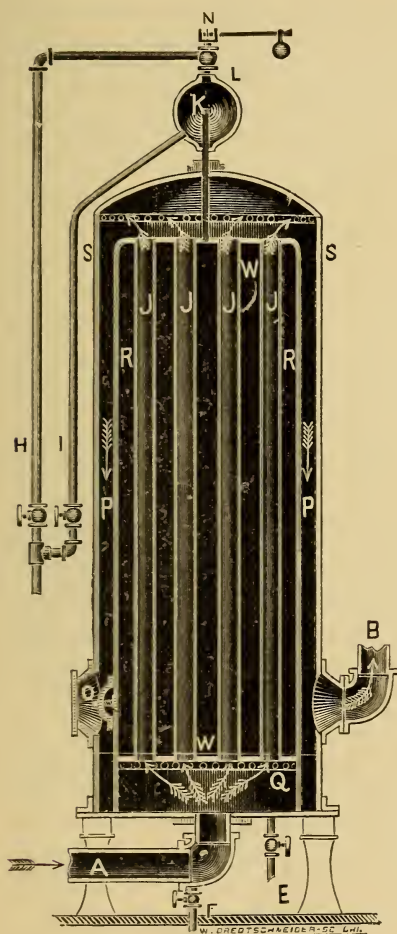


FIG. B.

steam from engine enters chamber Q from pipe A, up through tubes JJJ, and down annular space PP and passes through eduction pipe B.

Water cannot be purified without being boiled, and hence a heater that does not boil is useless as a purifier.

When water is boiled, most of the impurities at first rise to the top in the form of scum. To collect and expel this scum, a hollow ball or scum-chamber is attached to the top of their apparatus. This and the bottom blow-off are blown out as often as found necessary, generally about four or five times a day.

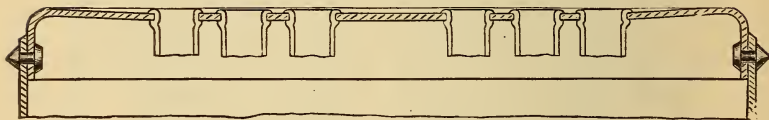
There are sometimes found impurities such as iron and sulphate of lime, which can only be separated from the water by evaporation

or by heating to a very high temperature. Only distilled water is absolutely pure, but water that has been boiled and had the scum and sediment removed is for boiler use practically pure.

The simplest way to keep a boiler clean is to clean the water before it enters the boiler.

Feeding cold water and the accumulation of scale is at the bottom of nine-tenths of the boiler repairs.

All engineers know the trouble so common in ordinary heaters, leaky tube ends. In their apparatus, when iron tubes are used, the expansion and contraction of the tubes and of the shell are the same, since both are made of the same material, of the same length and subject to the same temperatures, hence, leakage is avoided.



When brass tubes are used, the slight variation in the degree of expansion between the brass tubes and the iron shell, is overcome by their spring-tube sheets, which are made slightly concave as shown in the cut.

Their experience in the nine years during which they have been manufacturing their feed-water boiler, has demonstrated that for strength and durability the steam jacket feed-water boiler and purifier has no equal.

In breweries, packing houses, laundries and other places requiring large quantities of hot water, the advantages of using the steam jacket feed-water boiler are even more prominent.

Over a hundred breweries throughout the country are provided with their boilers, usually connected so as to heat all

the water required for brewing and washing kegs, besides feeding the boilers.

In steam laundries they will heat all the hot water required for washing machines and boilers.

In general, they will boil, if necessary, five times as much water as is required to furnish the steam for the engines from which they take exhaust.

The water is forced into boiler at feed pipe C, and leaves at D. O represents hand plate, L scum chamber, K pipe for connecting scum chamber with heater and N safety valve. When feed-water boils, the impurities rise to the scum chamber, the lighter or gummy body remains on top and is blown off from pipe H. Some matter is precipitated in the scum chamber and is blown off through pipe I. E F are drip pipes for draining water of condensation from boiler.

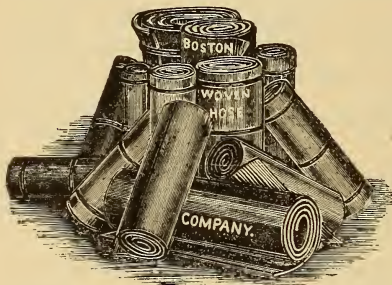
These boilers are constructed to suit the location, being vertical, inverted or horizontal, as is desirable, and all calculated to use exhaust steam only for boiling water.

The Eastern office is located at No. 12 Cortlandt Street, New York City, J. A. Crouthers, M. E., being the general manager.

THERE is no more important branch of manufacture than that of fire hose, for on its perfection both life and property often depend, and the smallest flaw in the manufacture may be the direct cause of the loss of both. Realizing this vital fact, and the responsibility that rests with the manufacturer, the BOSTON WOVEN HOSE COMPANY have been striving for some years to produce, as far as possible, the best fire hose which can be made from cotton and rubber, without regard to cost of experiment and outlay for new and improved

machinery. They have long been convinced that cotton hose, properly lined, makes the best fire hose, and in following this idea they have found not only their greatest profit but the appreciation of every fire department now using their "Boston Fire Jacket" and "Bay State Jacket" hose.

Up to about fifteen years ago cotton hose was hardly known, and from its conception through its various stages of improvement to its present stage of perfection, this hose has been most prominent. In following their improvements, perhaps, we can do no better than quote the following from the *Scientific American* (May 1886) : —

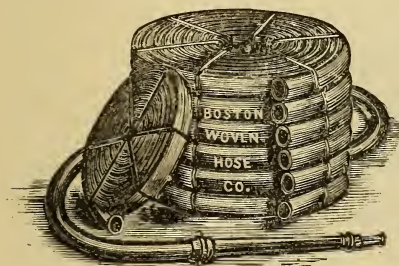


Their early efforts in this direction were in the manufacture of a fire hose of three plies of cotton, held together by threads and lined with rubber. Though an improvement over the ordinary rubber hose, this

proved rather stiff and bulky, and not altogether satisfactory to the manufacturers. They therefore made the experiment of forming their hose out of stronger yarn, and instead of having three connected plies, made it of two plies not connected. This change greatly increased the pliability of the hose, without in any way lessening its strength. They have since made other improvements in their fire hose, until the present product, designated as the "Boston Fire Jacket," will withstand a pressure of a thousand pounds to the square inch.

After perfecting the fire hose the company turned their attention to the manufacture of mill hose, which was much needed at the time. For this rubber hose has certain dis-

advantages. Besides being more bulky, it is apt to become dry, and crack, when left for any length of time. Under the same circumstances, linen would leak too much and would consume valuable time and water in swelling up before it was ready for use. Nor would it stand a heavy pressure. The cotton hose, however, has several qualities which make it particularly suitable. It can be packed away in small bulk, and besides being exceedingly strong, will not dry up, as the rubber in this case is made of the best quality, and is protected by the cotton cover. It has now been introduced into many large mills, and has proved very satisfactory.

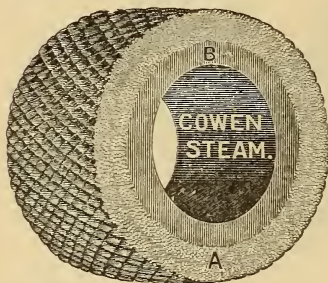


It is made in all sizes, to fit different stand pipes. The company have recently added the manufacture of garden hose to their other specialties. They started out with the determination to

make a cotton garden hose that would stand the wear and tear better than those now in use, and so far succeeded that its sales amounted to a million feet in a year. This hose is made on the principle that a string wound spirally around an ordinary hose adds greatly to its strength. The company believe that the superiority of this article is due to the fact that rubber hose is apt to decay, as the cotton duck on which its strength largely depends, draws in water at the exposed ends of the section, and at any injured place in the outer covering, until the entire length is saturated. The coats of rubber prevent the drying of the duck, and the confined moisture and sulphur in the rubber together prove so destructive to the fibre that it soon decays,

rendering the hose comparatively worthless, in spite of the purity of the rubber employed. The cotton garden hose, however, may be soaked every time it is used ; but, having no outside covering to imprison the moisture, will soon dry and leave the cotton uninjured.

The success of these different cotton hose encouraged experiments with steam hose. After a year's work at the problem, and the trial of numerous expedients, the present process was suggested, and having given excellent results, the product was manufactured on the large scale, and called, in honor of the inventor, the "Cowen" steam hose. It takes the place of a 7-ply marline wound, extra heavy, steam

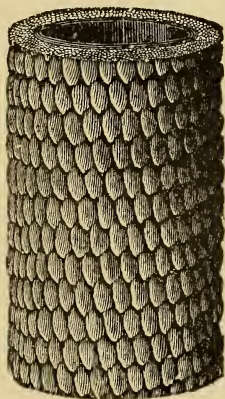


hose, and costs 20 per cent. less. It depends for its resistance to bursting pressure upon cotton jackets which are woven with heavy filling threads running spirally the whole length of the hose. The strength of rubber hose depends, in great measure, upon

the sticking power of the rubber between the different layers of duck. After steam has been run through it a short time, the rubber is apt to soften and give way. When this occurs, the hose swells or blisters and soon bursts. The Cowen hose is free from this danger. It has a lining which is cured just enough to stick to the fabric strongly, and in time with use becomes thoroughly cured by the passing steam. It has consequently a longer life than the ordinary steam hose. By the time it gets cured to the point where the rubber hose is at starting, it has already outlasted it and is good for a second term. Such a result is not possible with an ordinary rubber hose, since it is neces-

sary for the strength of the article that the rubber should be thoroughly cured in the beginning. The Cowen hose, gave very good results under severe tests. It has now a record of over six months' use on a dredging machine, under ninety pounds steam pressure, and of several months' use on rock drills.

It early became apparent in the experience of the firm that they would be obliged to make their own rubber tubes, in order to make good ones, so they have introduced into their factory, from time to time, rubber machinery of approved patterns, until they have now a thoroughly equipped



rubber plant in addition to that for cotton hose. Into this department they have also introduced many valuable improvements, and they manufacture their entire hose from crude material, which passes through no hands but their own until the complete fire hose goes into actual service.

The factory of the company is at Cambridgeport, and their principal office at 224 Devonshire Street, Boston. The officers are : Theo. A. Dodge, President, J. Edwin Davis, Treasurer, and Robert Cowen, Superintendent.

ECONOMY in the generation and use of steam has become one of the important questions of the day, and probably not one has given this question more thought than Mr. R. H. Zell, patentee of the Safety Boiler, whose description follows. The Zell boiler today stands unquestionably at the head of water tube safety boilers. There are two conditions necessary for the economical generation of steam :— 1st. Perfect combustion of the fuel, by which all its heat-producing properties are converted into heat. 2d. The utilization of the heat by its being most completely absorbed by the water and converting it into perfectly dry steam ; here is the essence of economically producing power.

By reference to the cut it will be seen that this generator consists of a series of four inch lap-welded tubes, placed in an inclined position, in sections of fours, which are expanded at their ends into rhomboidal-shaped headers or end boxes. These headers are made of special iron ; are carefully proportioned in the distribution of metal to effect strength and durability ; they withstand a hydrostatic pressure of 800 pounds per square inch. The sections are placed in vertical rows, bringing the tubes in a staggered position, and are connected together top and bottom with short pieces of four inch tubes or nipples, expanded in, the length and number of sections varying with the power of boiler required. The front of the generator contains two rows of headers more than the rear end, the tubes of the middle sections (at the rear end) being expanded into the side of the water drum or reservoir, which lays horizontally across the top of the rear headers, and is connected to them with nipples, expanded into the bottom of the drum. The top headers at the front end each contains two four-inch tubes extending horizontally back, and are expanded into the steam drum ; this drum is connected to the water drum

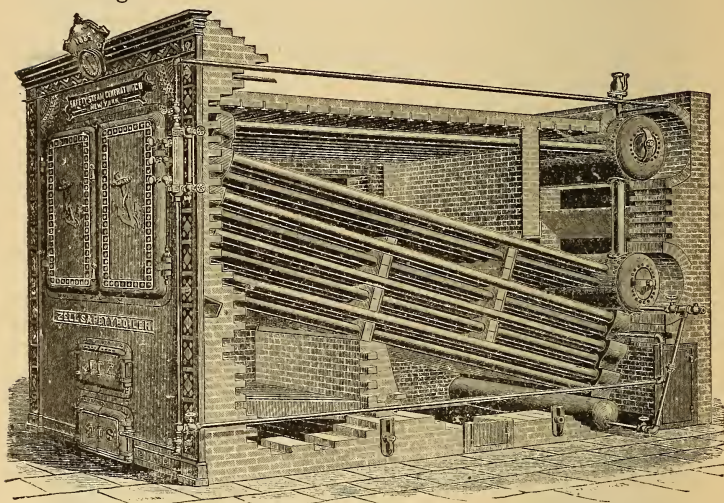
and rests on two iron upright pieces or saddles, which sustain the weight of the steam drum ; they are connected together by expanded tubes. Thus the generator is put together without a single screw or bolted flange joint.

From the fire in the furnace the products of combustion pass up between the staggered tubes, then down and around the tubes between the flame bridges to the bottom of the combustion chamber, thence up again, when they pass out to the chimney through the space between the steam and water drums.

The feed water is fed into the water drum in sufficient quantity to maintain the level at a point in the second series of water tubes, between the steam and water drums. The water in the inclined tubes next to the furnace being heated and raised to a rapid state of ebullition, the mingled body of steam and water, being lighter than the solid water in the rear water-drum, is forced up rapidly through the front headers to the second series of water tubes at the water line, (where this steam and water separate,) the water returning back through these tubes to the water-drum, while the steam passes up to the superheating tubes, which being surrounded with the radiated heat and gases, additional heat is absorbed. Evaporating any entrained water in its passage, through the steam tubes, the steam is delivered dry into the steam drum, which being jacketed by the waste gases in their passage to the chimney, and having a temperature a few degrees higher than the steam within the drum, more heat is absorbed by the steam and it becomes superheated.

The drums are each made of one sheet of steel, having a tensile strength of 60,000 pounds per square inch ; the tube plates into which the tubes are expanded, have the holes accurately cut, are of extra thickness, and riveted on to the drums. The heads are heavy and convex, and made of

flange steel ; each drum is provided with a man hole, faced off, in its end. The mud-drum, which is made of cast iron, the best metal to withstand corrosion, is placed below the bottom of rear headers, which is below the line of circulation, and is connected by nipples, expanded into the headers ; it has hand holes on the rear side for inspection or cleaning.



ZELL SAFETY BOILER.

The Rhomboid headers, of which we speak, have hand holes and plates opposite the tubes. These plates are on the inside of the headers ; both the surfaces of the plates and headers are accurately milled, so as to form a perfect metal joint ; the plates are held in a proper position by bolts, the heads of which are held in cored slots in the outer face of the plates, thus being protected from water, steam and gases providing against the corrosion of the iron in the bolts.

It will be seen that the pressure of steam holds the plates up to a joint without the aid of the bolts, which could be dispensed with when there is pressure in the boiler; the higher the pressure, the closer and tighter the plates are held to their places; the plan adopted in other boilers of putting these plates or caps on the outside and securing them by bolts from the inside, is a practice full of danger: for if the threads strip, or the bolts break under steam pressure, the plate will fly off, and the steam and boiling water will rush out, to the danger of every one in the vicinity. Moreover, the bolts are liable to corrode when they are in contact with the water on the inside of the boiler, which will in time weaken the iron. Plates of this description, when the joints leak, cannot be screwed up to tighten them while the steam is on, except at great risk; for in addition to the duty of making and preserving a tight joint, it has to stand the augmented strain to resist the steam pressure upon its whole area; and as these plates may be removed to clean or repair the tubes, by screwing the nuts so often the threads are in consequence of the great strain subjected to an increased wear. This will account for the fact that nearly all other sectional boilers are leaky about these plates—they are tightened up when cold; but when the pressure of the steam comes upon them, they are crowded off and cannot then be tightened.

The rear end of the boilers rests upon two cast iron saddles placed under the mud drum; the front end rests upon a roller which is placed upon the top of the arch-box. This box is bolted firmly to the boiler front and rests at its ends on brackets, bolted to the side columns, and being independent of the surrounding brickwork, the boiler is free to move with expansion and contraction without injury to the walls.

The arch over the furnace door is cast iron, through which there is a constant circulation of cold air ; it is also covered by fire brick lining, which protects it from the heat. It is a great improvement over the ordinary fire brick arches which are so generally used upon other boilers, and which have so often to be renewed causing delay and expense. The fronts are all of new designs and are made of wrought iron, with cast iron trimmings ; they never crack, warp, or twist out of shape ; are light to handle, and are a great improvement over the old style of cast iron fronts. The doors are light in weight, and are provided with liners of such shape and arrangement that they will not burn out. The workmanship and materials are all first class. The fittings all complete and of the best standard makes.

These boilers are manufactured by the DICKSON MANUFACTURING COMPANY at Scranton, Pa., and the success that has attended their introduction in other sections, promises well for their sale throughout New England, for which territory Messrs. HUSTON, PERRIN & Co., are the sole agents. The office of this house is located at 57 Oliver Street.

The BAY STATE BELTING COMPANY, manufacturers of pure oak tanned leather belting, raw hide and Indian tanned lace leather, was organized for the purpose of producing an article of superior quality at the least possible cost, and the success of their efforts is well attested by the result.

Their factory is located at No. 460 Harrison Avenue, where they have a thoroughly equipped plant for the manufacture of their products. Its reputation is rapidly becoming world wide and though one of the youngest of our belting corporations, it stands to-day with an enviable reputation among its older competitors. One of their specialties

is the Indian tanned lace, in sides from five to twenty feet.

This lace by an exhaustive trial test of ten years, has guaranteed its superiority to all other lace as regards evenness, elasticity, softness, pliability, toughness, the quality of not hardening in the belt, wearing quality, (extra wear being obtained by leaving the grain on,) and the absence of an excess of oil, which prevents the lace from slipping. It has been thoroughly tested by manufacturers and has given complete satisfaction.

The officers of the company are Samuel Cutler, President, Frank W. Carter, Treasurer, Geo. B. Boubotham, General Manager, each of whom are too well and favorably known to require any elaboration at our hands. Their salesroom is at 156 Devonshire Street, where their products can always be seen in great variety.

IN undertaking a review of the history of the steam interests of the city of Boston, a notice of the firms engaged in supplying steam plants and supplies would be incomplete without some reference to the subject of lubrication. Every engineer will recognize the importance of the subject of lubrication and its connection with steam engineering. To not a few the subject is prolific of vexation, and they will gladly welcome any information that affords them an easy solution of the difficulty they have experienced in procuring a suitable lubricant.

Engineers whose experience extends back twenty years, will recall the then universal use of sperm, whale, lard and olive oils, as the accepted lubricants, and all will remember the trouble experienced from the corrosive and deleterious effects resulting from the acids generated by the decomposi-

tion of these oils in the cylinders and steam chests of their engines and pumps.

To overcome this difficulty, mechanical engineers and chemical experts began experiments looking to the substitution of crude petroleum for the animal fats and oils in common use, and the partial success attained led to more exhaustive experiments in the manufacture of petroleum products, resulting in the production of a heavy distillate, having a superior body or viscosity, and greater lubricating value than the crude petroleum.

Prominent among the first in the field of discovery and practical application, the well-known firm of Leonard & Ellis were quick to introduce their superior products of petroleum, and labor early and late with mechanics and engineers who soon learned the value of the new lubricant and readily adopted it. The successful beginning gave promise of the future importance of petroleum products applied to lubrication and Messrs. Leonard & Ellis proceeded to enlarge their facilities and by the substitution of new and patented processes for the old and crude methods, greatly improved the quality of their products over all others. A constantly increasing demand gave evidence of the popularity and favor gained for their oil, which has for the past ten years, or more been known as "Valvoline," and protected by the following well-known trade mark.



Messrs. Leonard & Ellis have their home office in New

York and flourishing branch houses in Boston, Philadelphia, Chicago, St. Louis, San Francisco and London, England. Among their numerous agencies where Valvoline can be obtained, we can only mention those of Montreal, Halifax, Hamburg, Liverpool, Glasgow, Bombay, Calcutta, Rangoon, Barcelona, Seville, Alexandria, Constantinople, Creswick, Hong-Kong, Buenos Ayres, Java, Matanzas and the City of Mexico ; in each and all of the places mentioned, Valvoline has from the moment of its introduction held the leading place among lubricants.

The Boston house of Leonard & Ellis has for the last nine years been located at 149 Broad Street.

ONE of the enterprising concerns of Boston today is the AUTOMATIC FIRE ALARM AND EXTINGUISHER COMPANY, who are the introducers of the Watkins Automatic Fire Alarm and the Grinnell Sensitive Automatic Sprinkler, which are indorsed by the New York and Boston Boards of Fire Underwriters and the Factory Mutual Companies of New England.

A reduction of insurance of from five to fifteen per cent may be obtained by the Watkins Alarm.

This company now protects over \$1,000,000,000 worth of property, and their system is in use in over one thousand establishments. Among others may be mentioned : John C. Page, C. F. Hovey & Co., Lawrence, Wilde & Co., H. A. Turner & Co., Dame, Stoddard & Kendall, Morton & Chesley, Chase & Sanborn, Emerson Piano Co., Oliver Ditson & Co., Eastern R. R. Co., Hoosac Tunnel Dock and Elevator Co., Coleman, Mead & Co., J. S. Paine, L. Prang & Co., Eliot B. Mayo, Simmons, Hatch & Whitten, Burdett, Young & Ingalls, N. E. Organ Co., Hogg, Brown & Taylor, Chase

& Co., Wakefield Building, John H. Pray, Sons & Co., A. H. Davenport, John L. Whiting & Son, Jos. A. Jackson, Isaac Fenno & Co., Shepard, Norwell & Co., Hallett & Davis Piano Co., H. & G. W. Lord, Estes & Lauriat, Charles U. Cotting.

This is the only system of automatic fire protection which has proved itself, by time and actual results, to be absolutely reliable and efficient.

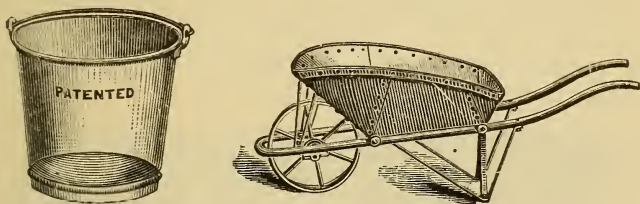
This company undertakes to protect all classes of property against loss by fire, by means of the Watkins Automatic Fire Alarm and the Grinnell Sensitive Automatic Sprinkler. They have devoted nearly twelve years and half a million of dollars to the development and perfection of a system which at all times and under all circumstances can be relied upon to do its work, and they stand by the record they have made as a proof of their success.

The Boston office of the company is located at 283 Franklin Street, the officers being, A. S. Barnes, President, Charles Bingher, Superintendent, Henry J. Miller, Agent, each of whom is most favorably known throughout New England.

THE house of GEO. D. PUTNAM & Co., 127 Milk Street, Boston, is the oldest mill supply house in Boston, and the only one carrying a full line of the various supplies used by cotton and woolen mills. Among its specialties may be mentioned, steam supplies, including the supplies used by engineers, among which we find cotton waste, steam packings, babbitt metal, machinery oils, files, wrenches, emery cloth, leather belting, cotton and rubber belting, hose for all purposes—steam, water and fire uses—fire pails, oily waste cans, etc.

The supplies needed in an engine room or factory are here found in stock and in great variety.

Their stock is always of the best, and supplies from them can be relied upon for superior quality. They stand today not only the oldest but one of the most popular houses in their line.



AMONGST the various appliances for saving and economy in the use of steam, but few are worthy of greater consideration than the proper application of some non-conducting covering to boilers, steam pipes and other heated surfaces, to prevent condensation and loss of heat by radiation as well as to effect a saving of fuel.

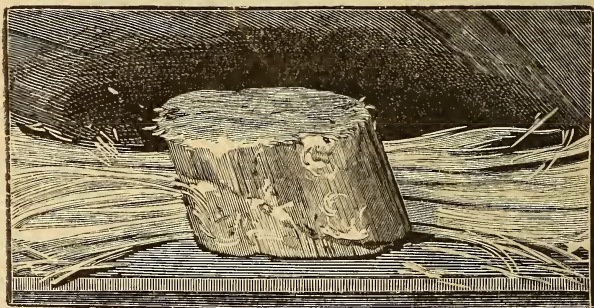
It is a question which interests not only the large manufacturer with his extensive steam plant, but every user of steam.

Many and various appliances for covering purposes have been invented and applied with varying success. Asbestos, owing to its fire proof and non-conducting qualities, early attracted attention, but the known supply of the article was limited and consequently costly.

Various inferior mixtures for covering purposes have been manufactured and sold by unreliable and unscrupulous parties, purporting to contain asbestos, and sold under that name, yet containing none of the mineral. For a while

they may have seemed to answer the requirements, yet after a time the heat from the inside permeating the mass and burning and disintegrating it, has caused it to crack and fall off.

THE ASBESTOS PACKING COMPANY have long been known as miners of asbestos and manufacturers of the article in all its various forms. With their superior advantages of securing the finest qualities of asbestos from their own mines, they can guarantee the users of their asbestos materials they are buying an article exactly as represented.



For the covering of boilers, flues, stills and other large heated surfaces, the steam pipes carrying high steam where a durable, useful and economical covering is desired, the Asbestos Packing Company recommend the use of their asbestos cement felting.

Their asbestos cement felting is guaranteed to contain a large percentage of asbestos fibre. It also contains a certain percentage of infusorien-erde (fossil meal, so called,) which is well known as one of the best non-conductors, owing to its peculiar construction and composition.

This infusorien-erde contains a large number of minute air cells which add to its non-conducting qualities and at

the same time render it very light. There are no deleterious or offensive ingredients in the composition of the cement felting, and nothing which can in any way injure the iron of the heated surface covered.

It is guaranteed perfectly non-combustible and cannot be injured by steam or heat at any temperature. It can be applied while steam is on, and therefore any delay is avoided. It is possessed of sufficient elasticity to contract and expand with the heated surface, avoiding any cracking.

It is valuable as a covering for boilers in the place of the ordinary brick covering, as it can be applied after the boiler has been tested and while the steam is on, and thus avoid any cracking of the covering consequent on the expansion of the boiler. Used in this connection it effects a great saving in radiation of heat. Instead of bricking the entire upper surface of the boiler, it is only bricked sufficiently far for the proper setting of the boiler. The asbestos cement felting can be readily applied on ceilings and walls as ordinary plaster, rendering boiler or engine rooms and other apartments thoroughly fire proof.

The results obtained by the use of asbestos cement felting have been the subject of many careful tests. The result of one such test taken by a prominent manufacturer without the knowledge of the company to satisfy himself, was as follows :—

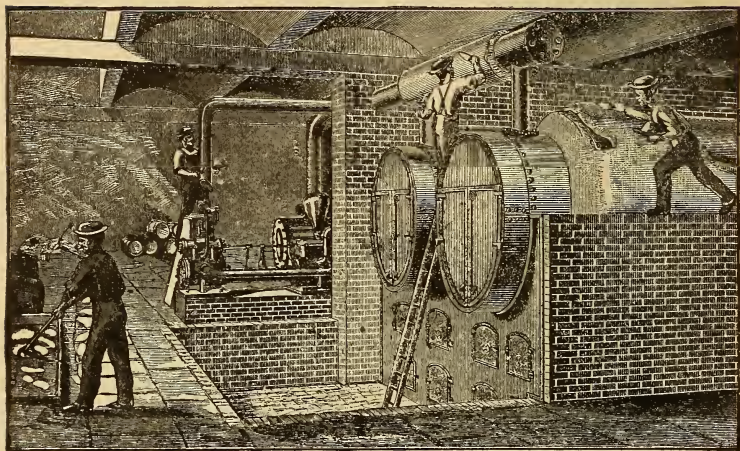
Temperature of the pipes before being covered, 220 degrees.

“ “ “ after being “ 90 “

Steam pressure on pipes, 65

For the covering of steam or other pipes exposed to the weather, the asbestos cement felting has proved to have no superior, as it requires no additional boxing or protec-

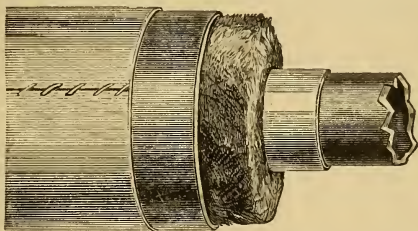
tion, and when used on under-ground pipes, it will withstand any degree of dampness.



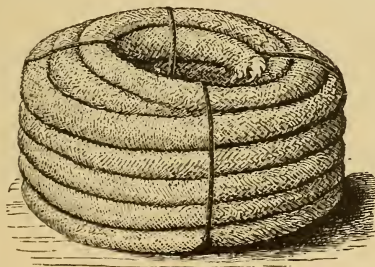
For the covering of steam pipes when it is desired to have a covering which can be removed or replaced at pleasure, the Asbestos Packing Company advocate the use of their asbestos and hair felt combination covering, which consists, first of a inside lining next the iron of one or more thicknesses of sheet or roll asbestos as may be required ; second, of a thickness of hair felt ; third, of a thickness of heavy felting paper ; fourth, of an outside covering of heavy canvas.

The heat of the pipe or boiler being prevented from passing to the hair felting by the insulating quality of the asbestos, it is almost, if not quite impossible for the most intense heat to affect the hair felting sufficiently to destroy its efficiency.

The Asbestos Packing Company also manufacture various grades of steam packings which find a ready sale and appreciation amongst engineers.

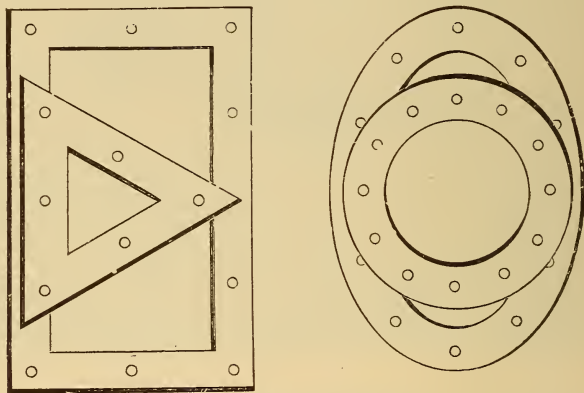


For a piston packing the asbestos rope packing which the company manufacture either entirely of asbestos fibre woven on the outside with yarn spun from the asbestos fibre, or of asbestos fibre with an admixture of plumbago and other lubricants, it will outlast any of the vegetable packings on the market.



For a valve packing, the asbestos wick packing has a world-wide reputation. As a substitute for hemp or cotton wicking, it will outlast them many times, being indestructible by any heat or acid, thus saving expense and labor and time replacing.

For a joint packing, the asbestos mill board manufactured by the company from pure asbestos, makes a perfectly and permanently tight joint. It weighs only about forty per cent as much as India rubber, and for making a good joint, a thickness of one-half that of rubber only is required.



The Asbestos Packing Company manufacture a variety of other goods for steam users, as well as a large line of roofing materials and fire and water proof building papers, etc.

The offices of the company are located at No. 169 Congress Street, Boston, and No. 33 John Street, New York.

THE importance of an appliance which will automatically control the draft of boiler furnaces as the pressure of steam rises and falls within the boiler, is well understood by steam users; in fact it may with propriety be said that a damper regulator bears a relation to the boiler similar to that of a

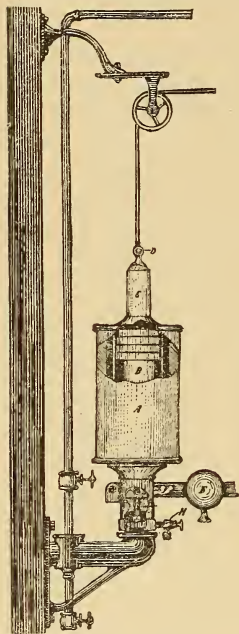
governor to the engine. Until within a comparatively short time the device generally in use is what is known as the diaphragm damper regulator, its construction consisting of a diaphragm of rubber placed between two concaved iron plates with a long lever suspended by a yoke heavily weighted at the ends near the point where the rod is attached to the damper crank, and is operated by boiler pressure upon a column of water which, forcing the diaphragm upwards as the pressure increases, raises the weighted lever closing the damper, the heavy weight bearing against the pressure drops down as the pressure diminishes, opening the damper in its descent. While performing their functions moderately well for a time, their reliability and promptness in action soon become impaired from the fact that the rubber diaphragm (which to this apparatus is as the main spring to the watch) by its action is constantly undergoing a process of disintegration; resulting in tardy action and final collapse. It is therefore evident that the need of a positively reliable damper regulator is felt, and as an instrument that will fully meet the requirement we present to our readers the Kellam machine which for eight years past has stood the test, and the popularity of which is manifested by the fact that many thousands of them are in successful operation throughout the middle and western states. Its introduction into New England is of comparatively recent date, yet it has secured lasting footing in many of the large manufactories in this section.

The true test of merit in instruments of this character is the promptness with which they respond to the fluctuations in boiler pressure, coupled of course with reliability and durability.

It is claimed for the Kellam that it will open and close a damper within two pounds variation of boiler pressure; in

fact cases are cited when the line on a steam recording gauge is shown so straight that no perceptible variation was indicated.

The construction of the Kellam regulator, as will be seen by the illustration, is radically different from all others known



to the market ; the special points of advantage being : that it is composed entirely of steam metal with all ground joints, having no diaphragm, packing, nor stuffing box ; that it is not affected by extremes of heat or cold ; that it is the only damper regulator operated by the immediate action of dry steam, and is more sensitive than any other, with the further advantage of being compact and nickle plated throughout. It occupies less room and is the most ornamental. Its method of operation is such that it can be located wherever desired and will work, if required, two or more separate dampers at the same time.

The general arrangement of the regulator is shown as connected with the damper by means of a wire rope passing over pulleys from the top of same. Attached to the wall by means of a bracket, B, the steam for operating being taken through the pipe A. The drip pipe D is to carry off the water from the pipe A, and the pet-cock E is to drain the water from the body of the regulator.

It will be seen that the instrument consists of a piston Y, upon which is a projecting ground joint W, containing water

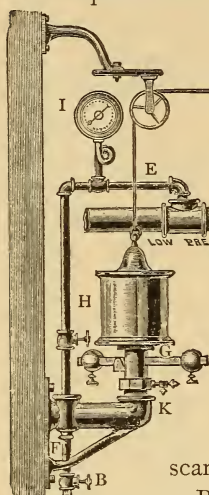
packing grooves, upon which works an accurately fitted cylinder K, which is in turn covered by a cap C, Fig. 1, weighing from 12 to 50 lbs., according to the size of machine. To the bottom of the piston is screwed the section U, in which is fitted the valve V. Upon this valve rests the stem P, the top of this stem bearing against the weighted lever F.

The operation is as follows : The weight (from $1\frac{1}{4}$ to $2\frac{1}{2}$ pounds) is adjusted on the lever A, so that the valve will open at the pressure which it is desired to carry on the boiler, when the steam entering ports P, passes through the piston Y, raising the cylinder gradually till cap L comes in contact with ground joint W, at which time the damper is entirely closed. As the boiler pressure lowers, valve V is pressed to its seat by weighted lever F, and as the condensation passes from within the piston through the pet-cock E, the cylinder descends drawing the damper open. So sensitive is this Regulator in its operation that the lightest pocket handkerchief thrown over lever F will vary its movement up or down.

In the preceding pages we have given a description of the Kellam damper regulator, and among other things new in steam appliances, now present a device by the same inventor for reducing steam from a high to a low point. As will be shown in the cut, the instrument in construction is like unto the damper machine ; the only difference being the shortening of the stroke and enlargement of the area of the cylinder. The arrangement and operation is as follows :

To the main steam pipe, A, leading from the steam-supplying boiler, is attached a balanced valve, D, which is opened and closed by a weighted lever, C, controlled by a wire rope, F, which passing over pulleys is connected with the regulator, H. The pressure desired is regulated by the small ball on the lever, G. At starting the valve D is wide

open, and will so remain until the receptacle becomes heated and by a back pressure indicates on the gauge I the heat or pressure required. This is obtained by the connect-



ing pipe, E, admitting steam to the regulator, being placed at the low pressure end of the valve D. As soon as the desired pressure is indicated, the cylinder of the regulator rises, and so shuts off the valve that a uniform pressure or heat is obtained; the regulator varying up or down as the pressure increases or diminishes; and so sensitive is this apparatus in its operation that there is scarcely a point of deviation.

Being composed entirely of steam metal without packing, diaphragm or stuffing box, is not liable to get out of order.

PHILADELPHIA, June 24, 1884.

Hine & Robertson, New York City :

DEAR SIRS :—We have Kellam's patent pressure regulator on the steam pipes used for heating our building, and take pleasure in testifying to its efficiency. The pressure of steam in the pipes, and consequently the heat, can be regulated with great accuracy. One very important feature of this machine is that it admits of a reduction of the steam pressure at night, so there will be only circulation enough to keep the pipes warm, which prevents the snapping and cracking through the radiators when the temperature is increased, as is the case under the

modes of regulating now in use. It is undoubtedly the best pressure regulator now in the market.

Very truly yours,

H. B. SMITH MACHINE CO.

J. J. White, Manager.

The importance of keeping the water-level in boilers as near a fixed line as possible, cannot be overrated by steam users, for the following reasons :—

First. Economy is gained from the fact that the heat is always being applied to the same quantity of water having the same temperature. That is not the case where at one time the water line is over high, giving an unnecessary amount of water to heat, or at another time, quite low, necessitating the pumping all at once of a body of cold water to absorb heat suddenly and thereby reduce the steam pressure. It can readily be seen that such variations in temperature and pressure must result in a waste of heat and fuel.

Second. Safety is gained by the impossibility of having low water, or, on the other hand, water too high, so as to work water instead of steam over into the engine or other steam apparatus. In a word, danger from low water is avoided and dry steam assured.

Third. Durability is gained by keeping the boiler at an even temperature and avoiding expansion and contraction due to an uneven temperature, which, as every steam user knows, is the main cause operating against the life of boilers.

Their regulator is so constructed that it can be attached to any boiler or steam generator, and will maintain the water-line at any desired point, any variation from which either higher or lower, will check or furnish the supply of water as

may be required. When the regulator is once adjusted, it requires no further attention, but will do its work perfectly.

It is not liable to get out of order, will last many years, and is acknowledged by all who are using it to be a safeguard against explosions, and a great fuel-saving machine.

This regulator is not only sure to pay for itself many times over by its saving of fuel, but is worth more than its cost in its saving to boilers from uneven temperatures. In places where the duties of engineers call them away from the boilers, this regulator is of inestimable value, for as soon as the water in boiler rises or lowers from the desired point, it is sure to operate and regulate supply of water to boiler. To any one who desires to economize and secure greater safety to his property and operatives, we would say try the Button regulator.

Either feeding one boiler, or any number from one pipe, it will show a large saving of fuel depending upon the amount of boiler service. A guarantee is given with every regulator.

The operation of the regulator is as follows: when the lower end of the pipe is submerged in the water, and air is allowed (when first starting the boiler) to pass off at the air-valve the water, as the pressure accumulates in boiler, will rise and fill the cylinder and iron pail. Being counterbalanced, the pail rises with the water in cylinder and shuts off the supply to the boiler. As the water in the boiler is evaporated and falls below the end of the pipe, because of its greater specific gravity than steam, the water in the cylinder falls back into the boiler, and the iron pail, containing ten or more pounds of water, follows down and starts on the feed. As the water again rises and covers the end of the pipe, and so cuts off the supply of steam to the cylinder, the steam which was in the cylinder is at once con-

densed, and the water again flows up to fill the vacuum. It will thus be seen that the operation of this most simple of all regulators is due to the inimitable law of gravity, and that no complicated machinery is needed or used to secure a perfect regulator. And so long as water shall have a specific gravity greater than steam, this regulator will work. There is a check valve next to the boiler. The cylinder is made of No. 16 copper corrugated, so as to compact the regulator, and give as large amount of surface as possible for variation. The pipe connected to the standpipe is for the purpose of connecting to the boiler or to the main standpipe.

S. D. WARREN & CO., PAPER MANUFACTURERS

CUMBERLAND AND PRESUMPSHOT MILLS.

CUMBERLAND MILLS, MAINE, January 3, 1886.

We have several of your Button boiler-feed regulators in use for the past six months, and they have performed their duty perfectly. We intend to put them on all our boilers (19) as soon as we can do so conveniently.

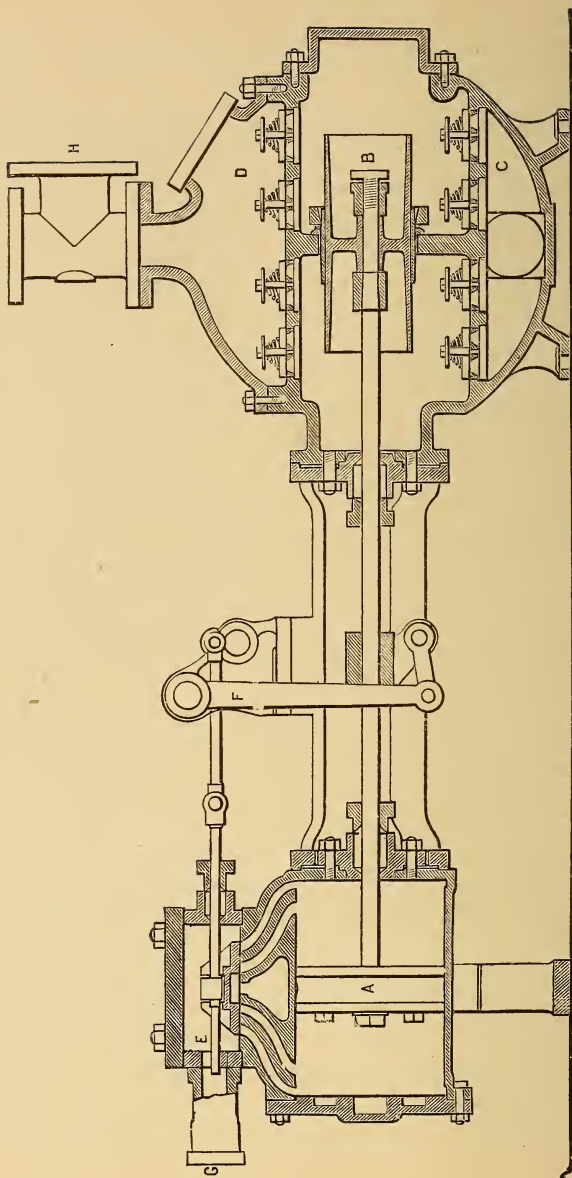
Yours truly,

(Signed) JOHN E. WARREN, Agent.

WHENEVER the earlier history of the Steam Pump and Hydraulic Machinery is mentioned, there is one manufacturing establishment which always stands out more prominently than any other.

The history of the HENRY R. WORTHINGTON HYDRAULIC WORKS is so closely interwoven into that of the steam pump that no historian can do full justice to the latter without devoting considerable space to this house.

To whom belongs the credit of introducing the steam pump may not be definitely known, but the progress of its



SECTIONAL VIEW OF A WORTHINGTON HIGH-PRESSURE STEAM PUMP.

development can best be illustrated in a few words by showing the increasing demand for the improved appliances which has augmented and enriched the greatest steam pump manufacturing establishment in the country.

Though in a small way at first, it was not very long before strict attention to business, the most skilled workmen and superior material in the construction of their appliances, had nearly doubled the demand for their products.

The important improvements which were made were grasped on their conception, and at once developed into important adjuncts to their original machine.

These were early times, and very notable and important times they were, too, in the history of the steam pump. Other houses sprang into existence, other pumps were placed on the market, other appliances came and went, but this house grew; orders began to arrive from Florida, California, Maine, Canada, and even from Europe, in fact, not to make too long a story, the plant has increased to thirty large buildings, each one containing at least twice the original space, making a mammoth establishment covering an area of two city blocks, and having accommodations for the employment of over twelve hundred hands.

The accompanying is a sectional view of one side or half of a Worthington high pressure steam Pump, of ordinary construction. Its object is to exhibit the great simplicity of its interior arrangement, especially that pertaining to the steam valve.

This valve, as may be seen at E, is an ordinary slide-valve, working upon a flat face over ports or openings. Its simplicity and durability, in contrast with any other form of steam valve, are well known. Although numerous attempts have been made to supersede it, it still maintains its place on locomotives and other forms of high-pressure crank

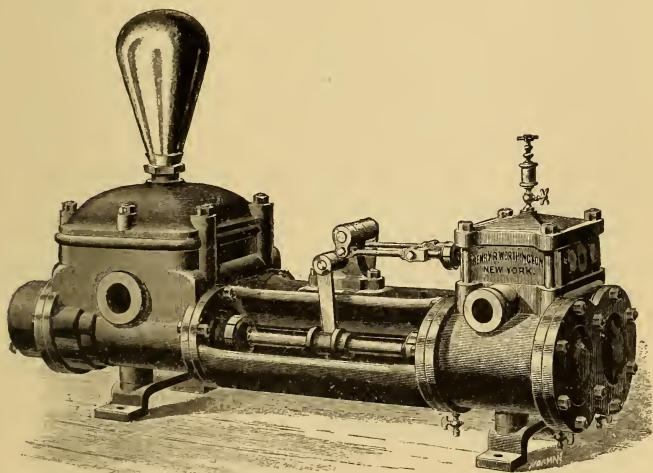
engines. No matter how long the engine may stand inactive, a slide valve will not rust or adhere to its seat, and is always ready to start when required. No water can collect in its cavities to produce trouble by freezing. In a word, it may be called the simplest and most reliable steam valve known to engineers.

In the Worthington engine, the motion of this valve is produced by a vibrating arm, seen at F, which swings through the whole length of the stroke, with long and easy leverage. As the moving parts are always in contact, the blow inseparable from the tappet system is avoided. Even the motion of the well-known eccentric upon crank engines is not comparable to this for moderate friction and durability.

Attention is also directed to the arrangement of the double-acting plunger, shown at B. It works through a deep metallic packing ring, bored to an accurate fit, being neither elastic nor adjustable. Both the ring and the plunger can be quickly taken out, and either refitted or exchanged for new ones at small cost, and if it be desired at any time to change the proportions between the steam pistons and pumps, a plunger of somewhat larger size, or decreased to any smaller diameter, can be readily substituted. As exact proportions between the power and work are always desirable, if not necessary, this is a very important advantage.

This system of renewal of the working parts has been proved by long experience to be the least expensive and most satisfactory for ordinary work. The plunger is located some inches above the suction valves, to form a subsiding chamber, into which any foreign substance may fall below the wearing surfaces. This enables it to work longer without renewal than the usual form of piston pump, especially in water containing grit or other solid material. The water

enters the pump from the suction chamber C, through the suction valves, then passes partly around and partly by the end of the plunger, through the force valves, nearly in a straight course, into the delivery chamber, D, thus traversing a very direct and ample water way. The bottom and top plates furnish a large area for the accommodation of the valves. These consist of several small discs of rubber, or other suitable material, easy to examine, and inexpensive to replace.



It is claimed that this machine is distinguished for great simplicity and strength of construction, having few moving parts, with no harsh motions, and not subject to fracture or other derangement.

The steam valve motion is fully described. To effect it, two steam cylinders and two pumps are placed together to form one machine. The right hand division moves the steam valve of the left hand one, and *vice versa*. Under

this arrangement one pump takes up the motion when the other is about to lay it down, thus keeping up a uniform delivery, without pulsation or noise. As the work is divided between two engines, the water is also divided, and the lifetime of the machine is doubled.

Added to durability, the smooth and noiseless action of this type of WORTHINGTON STEAM PUMP, makes it preferable on many important services, where the jar of a single cylinder pump would be objectionable or destructive.

The valve motion is the prominent and important peculiarity of this pump, as being that to which it owes its complete exemption from noise or concussive action. Two steam pumps are placed side by side, and so combined as to act reciprocally upon the steam valves of each other. The one piston acts to give steam to the other, after which it finishes its own stroke, and waits for its valve to be acted upon before it can renew its motion. This pause allows all the water valves to seat quietly, and removes everything like harshness of motion.

As one or the other of the steam valves must be always open, there can be no dead point. The pump is, therefore, always ready to start when the steam is admitted, and is managed by the simple opening and shutting of the throttle valve.

In its application to steam pumps for ordinary service, as well as to water works engines of the largest class, a combination of reliability, with economy in the first cost, and in running expenses, is attained, not realized by any other type of pumping machinery.

In the arrangement of the Worthington Steam Pump, special care has been taken to have the parts easily accessible for inspection or repairs. All the moving pieces being made to gauge, can be readily renewed.

One of the many specialties of this concern is the Worthington Compound Condensing Pumping Engine as applied to water tanks for large and important services, requiring the delivery of fluids against very heavy pressure. They are doing work approached by no other pump in this line, in nearly every large place in the country, and their contract pumping capacity per day of twenty-four hours to January first, 1886, reached the enormous amount of 1,000,000-000 gallons.

They have recently constructed two mammoth engines for the National Transit Company's oil pipe lines each being designed to deliver 25,000 barrels of oil a day against a pressure of 1,500 pounds to the square inch.

On this service, for which over thirty Worthington pumping engines have been constructed, it was found that all forms of rotative or single cylinder pumps produced such concussion on the pipes when running against this pressure as to lead to serious breakages of the machines, and constant leakage at the joints of the pipe lines. With the Worthington Engine, on the other hand, the variation in pressure while running at maximum speed is insignificant and unaccompanied by any jar whatsoever.

The engines here spoken of differ from those heretofore employed on this service, in that they have attached to them recent improvements whereby their economy in the consumption of fuel is greatly increased. These improvements consist of a simple attachment, that can be placed upon any form of Worthington pumping engine, and that, without altering its character of motion in the slightest, enables it to perform its work with the consumption of as little coal as would be required by the most economical types of pumping engines of whatever form of construction. In other words, this attachment enables the Worthington Pumping Engine

to readily achieve a duty of 100,000,000. Exhaustive tests have been made where this duty has been considerably exceeded.

To say that more than ordinary success has been attained by this company is to say but little, as its reputation is bounded only by the demand for the best and most approved appliances.

They have been awarded first premiums and diplomas at all exhibitions, the following being received at the

INTERNATIONAL EXHIBITION,

PHILADELPHIA, 1876.

The United States Centennial Commission has examined the Report of the Judges, and accept the following reasons, and decree an award in conformity therewith.

REPORT ON AWARDS.

PRODUCT.—The Duplex System of Steam Pumping Engines, patented and exhibited by

HENRY R. WORTHINGTON,

NEW YORK.

The undersigned having examined the product herein described, respectfully recommends the same to the United States Centennial Commission for award for the following reasons, viz. :—

The duplex system of pumps is of well established excellence, and is considered a positive advance in the art of moving water under pressure by means of pistons. The system permits of remarkable simplicity of construction, and insures smoothness of working, efficiency of action and reliability for extended use whatever the pressure or length of the water column or the size of the apparatus employed. For pumping engines, compound steam cylinders are provided to secure economy of fuel.

W. H. BARLOW, *Judge.*

Approval of Group Judges :

N. PETROFF,	HORATIO ALLEN,	EMIL BRUGSCH,
CHAS. E. EMERY,	CHAS. T. PORTER,	F. REULEAUX,
	JOSEPH BELKNAP.	

A true copy of the Record.

FRANCIS A. WALKER,

Chief of Bureau of Awards.

Given by Authority of the United States Centennial Commission.

J. L. CAMPBELL,

Secretary.

A. T. GOSHORN,

General Director.

{ L. S. }

J. R. HAWLEY,

President.

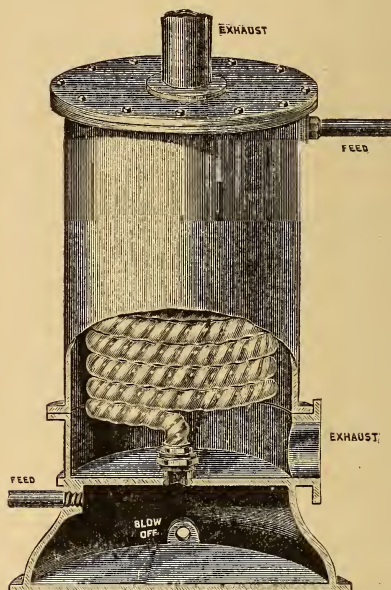
The office of the company is located at the Mason Building, 70 Kilby Street, where the products of the factory may be seen in great variety.

All of the gentlemen connected with the enterprise are each too well and favorably known to require any remarks in this connection, and in its prosperity the company is reaping an ample harvest from the seed sown so many years ago by that pioneer in the manufacture of steam pumps, Henry R. Worthington.

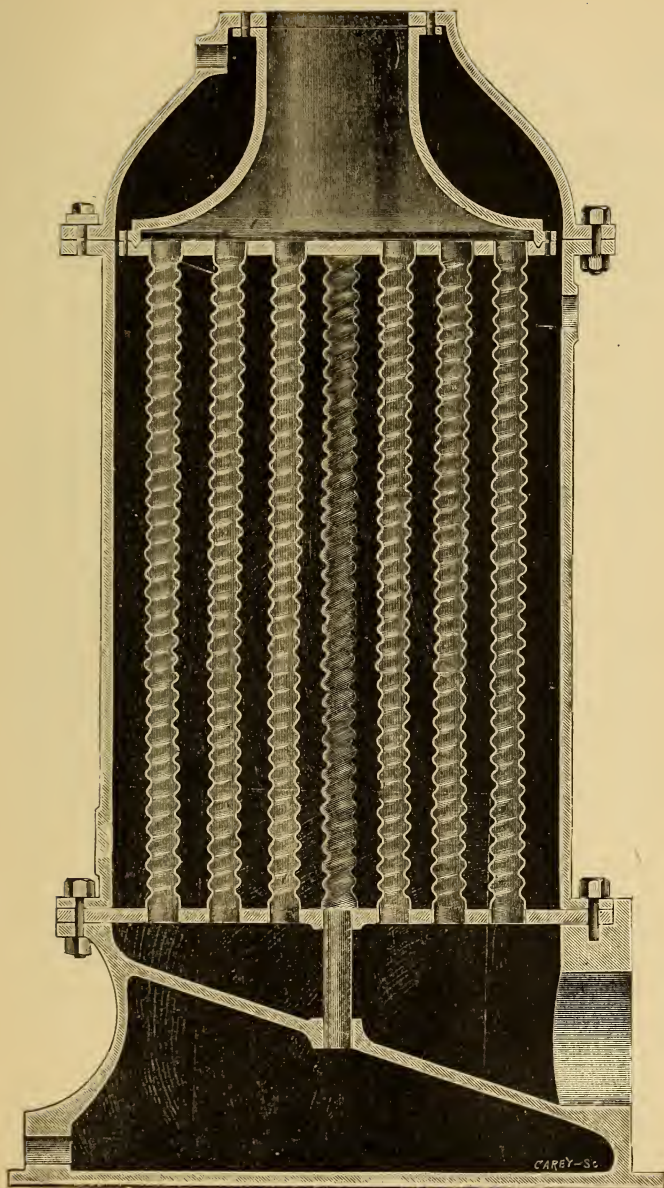
MECHANICS, knowing by experience the forces of expansion and contraction, appreciate the mechanical value of tubing which permits both expansion and contraction without injury to connection. Corrugated tubing overcomes this most difficult problem in the fitting of steam and water-pipes. All experiments hitherto made to provide a perfect corrugated tube at a reasonable cost, have been unsuccessful. Previous attempts have only resulted in tubes of unequal thickness at large cost of production. As the outcome of

long experimental work the WAINWRIGHT MANUFACTURING COMPANY have succeeded in corrugating tubing of even thickness throughout, which can be marketed at prices competing favorably with plain tubing.

The process which they control permits the use of very thin metal, and at the same time preserves all requisite strength.



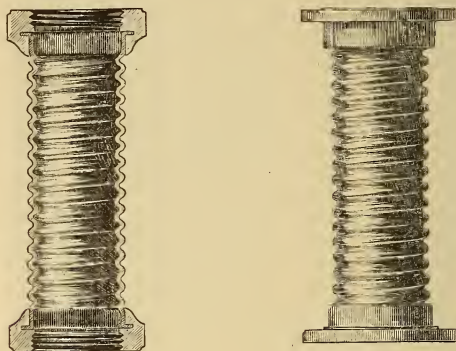
They can corrugate boiler tubes, cylinders, furnaces, surface or marine condensed tubes, economizer tubes, stationary or locomotive heater tubes, radiators, expansion joints, etc. The same improvement may be used in all metals where the force of expansion must be met, where great strength of resistance is requisite, or where large area of surface is desired in a confined space.



The objects attained by this form of corrugated tubing or cylinders, are :—

Great strength of resistance to collapse from internal or external pressure. The corrugation forms a succession of arches, longitudinal and transverse, and experience has shown that with the same diameter and thickness, the strength of the metal when corrugated is five times greater than when plain.

A 33 to 100 per cent increased, and, therefore, more effective heating and cooling surface, occupying the same space as a plain tube. The superior strength gained by the corrugation, permits the use of a thinner tube or cylinder,



which gives greater efficiency in the transmission of heat, with a corresponding economy of metal and fuel, and with the rapid escape of gases retarded, gives fully 50 per cent more evaporative power. The converse quality of condensing or cooling power is likewise secured.

Longitudinal flexibility, providing against unequal strain caused by expansion and contraction. All strain from heads of boilers is thereby removed, obviating leakage of joints or

fracture of connections, and, by the prevention of wear and tear, durability and safety are much increased.

Freedom from damage by incrustation or scale. The corrugation causing a uniform longitudinal expansion and contraction, is self-cleaning, and automatically frees itself from scale and sediment. This advantage alone largely increases its value over plain tubing.

The ends of tubes or cylinders may be left plain to admit of easy expansion into boiler heads, or to whatever use they may be applied. They can also be left plain in any desired portion of their length.

The WAINWRIGHT MANUFACTURING COMPANY have built at Medford, Mass., extensive works, comprising a four-story machine shop, iron foundry, brass foundry, pattern shop, blacksmith shop, with stables and ample storage for raw materials, and are running out large quantities of corrugated tubing to order and for their own specialties, particularly for their feed-water heaters which they manufacture in various forms. The company make a specialty of the purification of feed-water, eliminating all carbonate and sulphate of lime by the use of proper heaters and then by filtration removing all mechanical impurities, delivering the water to the boilers soft and pure. The feed water heater shown here is operated with the water outside of the corrugated tubes, heating it by exhaust steam to an average temperature of 210 degrees.

Another type of heater is also shown in which the feed-water is forced through a coil of corrugated copper tube, the exhaust passing around it. A settling chamber with blow-off allows the removal of any sediment deposit.

The company also utilize brass corrugated tube in the manufacture of radiators, which by their compactness, lightness and efficiency meet with general approval.

They also make expansion joints in which corrugated

copper tubing is substituted for the ordinary slip joint, the expansion and contraction taking place in the corrugations. These expansion joints are endorsed by the leading steam heating companies.

The offices of the company are located at 65 and 67 Oliver Street, Boston, and 93 Liberty Street, New York, Messrs. Fairbank & Co. being their representatives in Philadelphia.

The officers of the company are Chas. D. Wainwright, President, William T. Andrews, Treasurer, and R. T. Pratt, Superintendent.

Although the company is a comparatively new one, its officers are young and energetic business men, and we can confidently predict an extended and successful business.

EXPERIENCE has demonstrated that the HANCOCK INSPIRATOR is the most reliable and economical device for feeding water at all temperatures, to boilers of any construction or in any service.

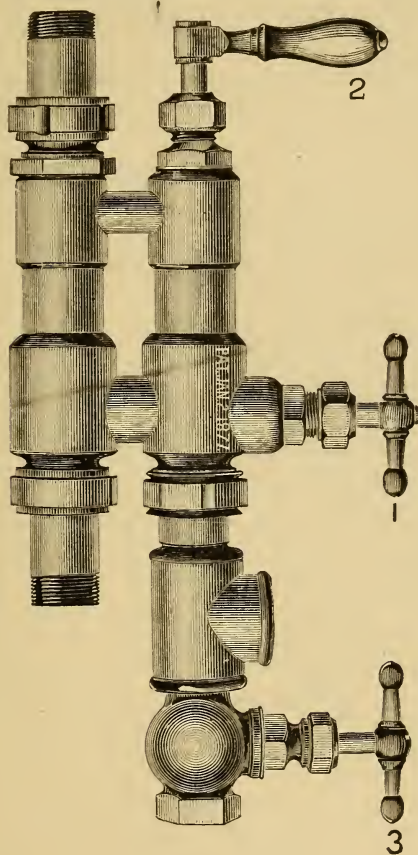
It is a device too well known among progressive engineers to need any elaboration in this connection.

It is an apparatus for feeding water to steam boilers, for filling tanks, and for any and all purposes for which a pump may be used in handling water. It has no movable or working parts, is durable, and will not get out of order.

It is a double apparatus, one-half of which is a lifter, and the other half a forcer; the lifter drawing the water and delivering it to the forcer, which delivers it to the boiler, at any steam pressure, without adjustment.

An ordinary injector is a single apparatus, and requires adjustment for the varying steam pressures.

On some accounts it is more reliable than a pump, as there are no valves or movable parts to break or get out of order,



and it will work under all the conditions where a pump would be used.

Not requiring as much steam as a pump, its advantage is

two-fold, inasmuch as all the steam required to operate it is condensed in the water — thereby heating it — and returning it to the boiler, and enabling hot water to be fed to the boiler without the use of a heater.

The only loss of steam by using the inspirator is by radiation from the pipes, and this is no greater with the inspirator than with the pump.

It will lift water twenty-five feet, and deliver it into the tanks, or to the boiler as may be desired, requiring only forty-five pounds steam pressure.

It will take water at 140 degrees F., on a lift of three or four feet, or under a head; and on a lift of twenty-five feet it will take it at from 90 degrees to 100 degrees F., increasing the temperature nearly 100 degrees.

There are upwards of 100,000 of the machines in successful operation in all parts of the civilized world, and they stand today unrivalled in their special sphere.

The inspirator is the invention of the late John T. Hancock of Jamaica Plain, who devoted years to study and experiment before he succeeded in perfecting this device. The inspirator was patented in 1877 and the Inspirator Company was organized under the general laws of Massachusetts in the same year. In 1884 the company erected a large factory on Baldwin Street, at the South End. Its dimensions are 200 x 40 feet, and four stories high, with wings for foundry, and for boiler and engine rooms, and with the improved tools and facilities for manufacture are in a position to supply any possible demand, and to meet the market as to prices, etc. The present organization of the company is H. M. Whitney, President, J. E. Blakemore, Treasurer, B. H. Warren, Superintendent.

The office of the company is located at 33 India Wharf.

ONE of the most successful firms in the city in their special line is that of W. H. GALLISON, who in 1869, seeing the necessity of furnishing engineers with the most approved supplies, began the business which is today so well known throughout New England. Though keeping in stock nearly everything in the way of general supplies, such as iron and brass pipe fittings, he makes a specialty of several appliances among which may be mentioned the Universal Polishing Paste, or Putz-pomade, for polishing and cleaning all metals such as brass, copper, nickel, silver, gold, etc.

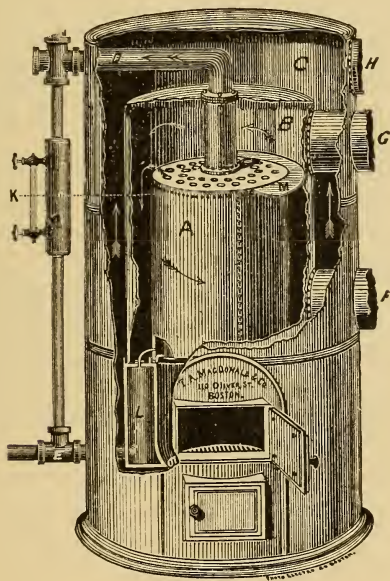
This now well-known article was first manufactured in Germany in 1878, its principal ingredient being the mineral powder (putz-pulver) owned by Alexander Radesich, of Trieste, Austro-Hungary, where its great merit gained for it a reputation throughout Europe. In 1882 it was deemed advisable, on account of the demand on this side of the Atlantic, to establish a factory in the United States, and Messrs. Borsum Brothers came here for that purpose, with the sole right to import and sell the "Putzpulver" from which all genuine Putz-pomade is made, in America. They considered it advisable on their boxes to use the English term "polishing paste," rather than the German "putz-pomade" which has the same meaning, and registered the figure of a trumpet as their trade-mark for the United States. The great favor with which the genuine paste was received, and the increasing demand, has induced the production of a number of imitations in this country and Europe, all of which are worthless, and some actually destructive of any fine ware which they are applied to. The public is therefore cautioned to buy only the genuine paste with the trade-mark of a trumpet and the name of Borsum Brothers, if they wish to avoid disappointment. This notice

is deemed especially necessary in view of the fact that various irresponsible parties who travel about selling worthless compounds, have had the audacity to denounce the original paste as an imitation and a fraud. The taking of the general agency of this paste by such a well-known and established house as that of Wm. H. Gallison is a guarantee that all is as it is represented to be.

They are also agents for the Lonergan patent Oilers and Lubricators, H. S. Ingalls self adjusting Boiler Tube Scraper and Cleaner, the Ashcroft Manufacturing Company, of New York, and many other well-known houses. Mr. Gallison gives his personal attention to the business, and the success which has attended his efforts to please those who favor him with their patronage amply demonstrates the worth and reliability of this house.

M. HANFORD was born in Red Bank, N. J., October 4, 1841, coming to Boston in 1851, where he attended the Lincoln, Adams and Chauncy Hall schools until 1857. He then went to Westboro and served his time at the blacksmith trade. In 1862 he went to Brooklyn, N. Y., where he became interested in the machinist trade and served his time. Three years later his services were secured as engineer in the Eagle Sugar Refinery, where he remained until 1870, when he invented and patented his well-known double screw and drum elevator which he has placed in many large buildings in New York, Philadelphia, Boston and other well-known places. It is one of the improved appliances of the age and the success which has attended his labors demonstrates the popularity which his invention has attained.

THE Combination Hot-water and Hot-air Heating Apparatus, manufactured by T. A. MACDONALD & Co., 110 Oliver Street, Boston, and 149 Broadway, New York, is commanding considerable attention for its superiority of construction, the objects of which are to produce a pure warm atmosphere uninjured by being brought in contact with high tempered surfaces. To economize in the use of



fuel, durability, economy of construction, adaptability, efficiency, simplicity, safety, and facility of management.


The efficiency of a heating apparatus depends very much on the manner in which it is put in a building, such as the proper proportion of the heating surface of the boiler to the radiating surface and that to the size and structure of the

building, and the proper location of the radiators and position of the pipes, all must be taken into consideration. Often the reputation of a good heater is damaged by not being properly proportioned to the building it is intended to heat. It is next to impossible to heat some buildings properly from one hot-air chamber, on account of the unequal draft of the different apartments, some being too warm while others, (generally the coldest and most exposed apartments) are the difficult ones to heat. With this heater the halls or apartments near may be heated from the hot-air department and a stack of radiators especially located to heat those apartments which are most exposed and difficult to heat. Thus we have a positive heater.

Also by ventilating and heating the halls thoroughly the rooms may have a direct radiator in each, and it is found that while this system is the cheapest and most economical, it is also efficient and easy to manage.

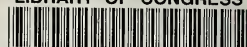
The rooms will receive part of the ventilation from the halls, especially if there are ventilators over the doors, but apartments (such as auditoriums for instance) in which large numbers are congregated, should be heated by that system known as indirect radiation where the stacks of indirect radiators are placed under the first floor in casings, with an air space above and below them. The cold air is admitted through a cold air duct to the lower space and passing up through the stack of radiators becomes heated in the upper space or hot air chamber, and is conveyed from there in the tubes to the apartments above.

This system is neither as cheap or as economical in the use of fuel as the direct system, but it is, nevertheless, the proper system in such cases, for the proper ventilating is as important as the proper heating of such apartments, and they should be so constructed as to facilitate their objects.





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